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A RAILWAY THROUGH THE SEA.

A small seashore tramway has for some years been in operation at Brighton, a center rail being employed to carry the electric current. Mr. Magnus Volk is the proprietor of this small tramway, and its success led him to seek means of extending it to Rottingdean. The distance of this place from Brighton may be only three miles to a crow, but to an ordinary mortal it is a goodly four. There were difficulties in the way of extending the system as it stood. Owing to the foreshore between Brighton and Rottingdean being for the greater part of 24 hours covered by water, it appeared that the best way of constructing a line would have been to take it over the cliffs. After careful consideration, however, Mr. Volk determined to use the foreshore at a point slightly above low water mark, but some 14 feet below the sea at high water. As it was proposed to run the cars irrespective of the condition of the tide, it was necessary to provide a vehicle of very special construction. It will be seen from the illustration that the projectors of the line have succeeded in building a car that is totally unlike any other form of movable structure, not excepting even the ark. The important characteristic of the vehicle is a structure half boat and half car, which is mounted on four long legs, at the end of which are the wheels.

Although the railway which has been just completed at Brighton will have no important bearing on the question of electric traction, still the system presents many ingenious features which are interesting to engineers.

The chief peculiarity of the track is the employment of four rails, and when the tide is down, and the lines uncovered, it has the appearance of double lines of exceedingly narrow gage. The line consists of four rails of 54 pounds to the yard, the distance between the two outside rails being 18 feet, which gives an idea of the width of the car. In laying the track there were many difficulties to overcome, the fact that work could only be done when the tide was down, coupled with the possibility of the incoming tide undoing what had been done, gives an indication of the nature of the operations. The rails are securely fastened to concrete blocks placed every few yards, by means of steel clips and bolts, the bolts passing through oak blocks placed between the rails and the concrete. Tie rods are used every ten feet on the straight and every five feet on the curves, heavy angle fish plates being used for the rail joints.

The feature of the system is the car, which is furnished with 16 wheels. Each leg of the car is mounted on a four-wheel bogie, and the wheels of the bogie run on the narrow gage line. It will be noticed that the bogie trucks are shaped like a double-ended boat, to facilitate passage through the water, besides removing obstructions from the lines. The four bogies are firmly held together by steel tubular struts. The wheel base is about 28 feet, and this, combined with the effective gage of 18 feet, ought to give sufficient stability. The tops of the main legs carry lattice girder work, on which the main deck is erected, the whole structure being braced together by means of cross ties. Before passing on to speak of the means of driving, it will be interesting to refer to the upper part of the structure. The idea of Mr. Volk and his assistants has been apparently to reproduce, as far as possible, the special features of a pleasure yacht, for the main deck appurtenances and erections are carried out as one would expect to find them on a model steam yacht. Indeed, they go so far as to carry a small boat and a supply of life buoys. The main deck is about 50 feet in length and 22 feet in width. There are iron railings round the deck, provided with wire netting. The center of the deck is taken up by a saloon, which is 25 feet long and 12 feet wide; the interior being furnished and upholstered in a very handsome manner. A second deck has been made on the top of the saloon, and, altogether, the carrying capacity of this car yacht must be approaching 200. As an easy means of enjoying sea breezes without drawbacks, this railway ought to be unrivaled.

Coming to the means of propelling this structure, it ought to be observed, first of all, that electrical energy is conveyed to the car by means of overhead wires, the necessary collection of current being performed by two trolleys of a special type, devised by Mr. Philip Daw-

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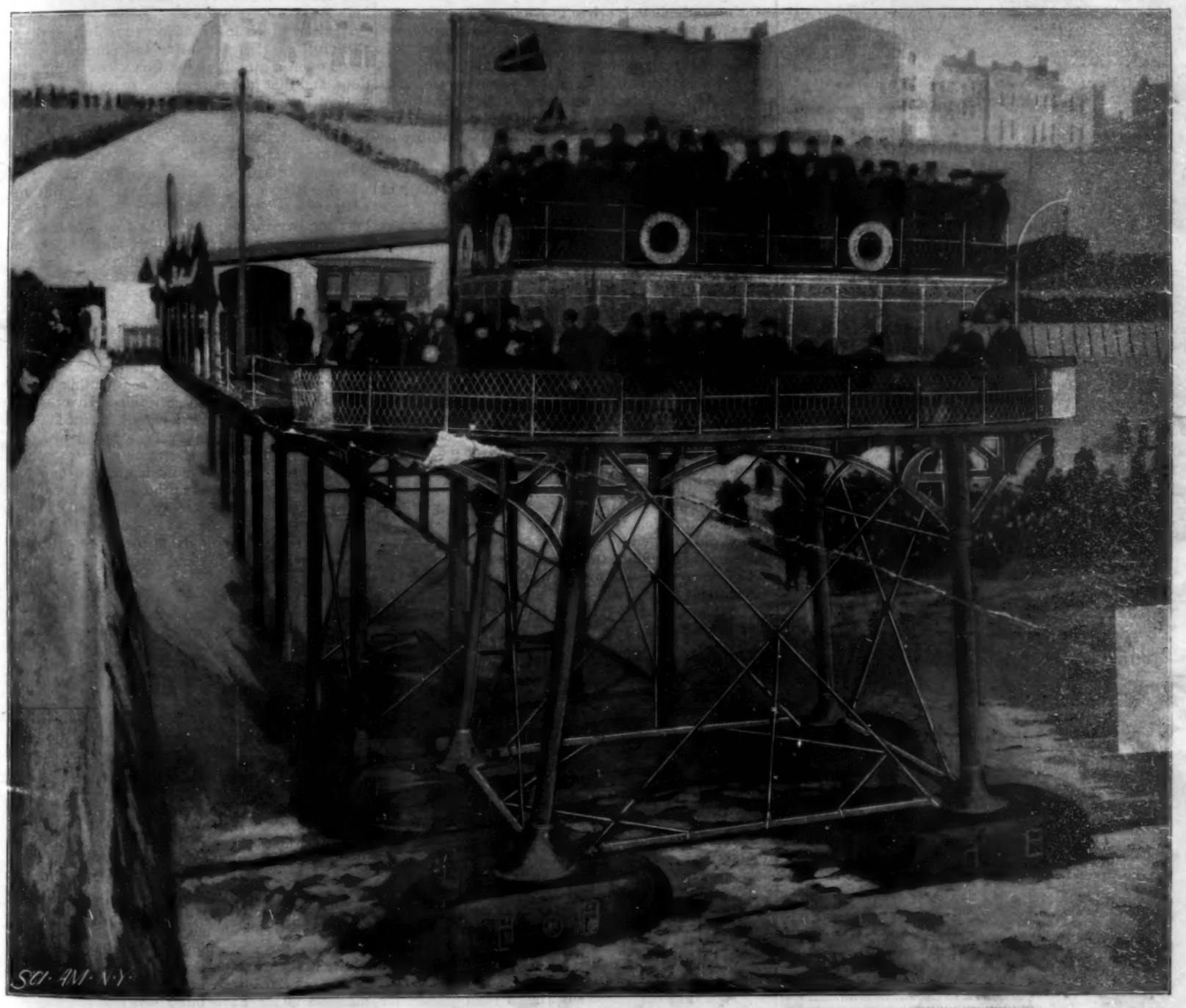

THE NEW ELECTRIC SEA RAILWAY BETWEEN BRIGHTON AND ROTTINGDEAN, ENGLAND.

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DISHONEST PATENT METHODS DETECTED.

Our recent comments on the lottery system of patent practice have attracted so much attention that it is evident that the evil is a great one. It is well to be able to punctuate remarks in abstract with examples from practice, however unfortunate it may be that such examples should exist. The public, however, it is to be hoped, are awaking to the fact that the personal element in patent practice needs purification. Under existing conditions, inventors themselves must do the purifying by selecting reputable firms for their representatives in Patent Office proceedings.

The disreputable practitioner generally lays himself open to identification—distinctive earmarks are to be discerned in his ways and methods. Anything savoring of the gift enterprise should excite suspicion. A flaring colored circular offering to give something for nothing, one which tries to impress upon the constitutionally sanguine inventor that it is a simple matter to make a paying invention, suggesting speciously the probable sale of a patent under such terms as to read almost like a guarantee on the part of the firm issuing the circular to effect the sale—such are means of identification.

The preliminary search requires a certain time for its execution, and a definite responsibility attaches to it. Among the inducements offered by one of the firms which we allude to is a free Preliminary Examination. The effect of a preliminary search is often to show the invention has been anticipated, and it is therefore obvious that a firm anxious only for fees has no inducement to make it a thorough one. As they claim to make it for nothing, a reasonable view of this case would be that the examination would be worth to the client precisely what it cost him, viz., nothing at all.

We have received unsolicited, and from a stranger, an amusing account of how he tested the value of the free Preliminary Examination methods. He procured from the Patent Office a copy of a patent, and copied one of its drawings accurately, and from its specifications compiled what purported to be a description of an invention. The alleged invention thus composed was submitted to a Washington firm who advertise exclusively in the papers, and also offer to make free Preliminary Examinations. After a sufficient lapse of time, he received what purported to be a typewritten letter, evidently a lithographed form, in terms quite general and applicable to various cases, praising the invention. This circular said as the result of the preliminary search that the invention seemed to be new and patentable and of so much value and importance that the work of preparing the papers had already been begun, in order to file the application in the Patent Office before any one could steal the idea. The letter is now in our possession, with a copy of the patent from which the decoy was constructed. The report did not cite any patents or references as touching or resembling the invention, and the inference to be drawn from the report was that the invention was entirely new.

Of course, no Preliminary Examination whatever had been made, the firm in question not using any such method to enlighten their clients at the risk of losing a dishonest or questionably earned fee. The skillful make up of the letter is interesting. The appearance of poorly impressed typewriting is reproduced perfectly. The name and title of invention are struck in with precisely the same colored ink as that in the text or body of the letter. We have designated certain practices as being in the order of lottery and gift enterprises. It is hardly too much to say that here we are brought face to face with methods, if possible, even more questionable.

There is no patent bar, and no provision for adequately coping with acts which are unprofessional, perhaps not dishonest in the statutory degree, but in morals thoroughly bad. The professions of lawyer or of physician are far better safeguarded, and it is to be hoped that we shall yet see a patent bar established, admission to which shall only be granted to reputable practitioners, membership in which should almost guarantee responsibility and honor, and whose members should be subject to suspension from practice for deeds of questionable honesty and unquestionable dishonor.

INVENTORS AND THEIR INVENTIONS.

A contemporary technical journal on the other side of the water is lending its columns to the discussion of the question as to how the results of invention can best be secured to the inventor. In a recent issue it publishes a lengthy letter, in which the writer makes some sweeping suggestions looking to the reform of patent practice. The fact that a leading journal should have requested such a letter, as the writer states, and given it a prominent insertion, shows that its subject matter is considered to be timely, and, to a certain degree, indicative of the trend of public opinion on the question of patent practice as it exists in England.

Briefly stated, the proposed reform consists of a scheme for the examination and certification of the results of invention by an independent and competent authority, and the watchword of reformers in the matter of invention is to be—"a title for the results of invention founded, not upon 'novelty,' but upon such novelty as renders invention of practical value to the public." In other words, "novelty" is always to be construed "novelty of practical value" in the public sense.

The writer opens his argument by virtually begging the question, or a large share of it, in stating that there is no such thing as novelty in invention. He makes this statement on the basis of the following considerations: That the inventive faculty consists, first, in the power, conscious or unconscious, of tracing the threads of intercausation which connect natural phenomena, and, secondly, in the power of grasping the definite results which follow; that this faculty is present more or less in all men; that it is so rapid in its action in some men that its results seem to be intuitive in their nature—as something born de novo; that the history of all great inventions includes a prolonged preparatory study of the subject, followed by the "occurrence" of an idea and a long period of hard work in evolving that idea to a practical result; and that, therefore, the novelty so generally considered as a necessary condition of invention "does not, in point of fact, exist as an intrinsic quality in any invention; it only exists as a sort of convenient fiction to mark the individual value of results."

To all of which it is sufficient to reply that the novelty of patent law is relative and not absolute, being based upon a careful comparison with previous inventions, and that in this restricted sense it is not a "convenient fiction," but an exact term with a clearly defined meaning.

The writer then proceeds to show that so long as the inventor is satisfied to find his sufficient reward in the attainment of results, no one has any business either with his labor or the nature of his results. But so soon as he steps beyond this boundary, and turns to his fellows for recognition, and seeks from them a reward based on the result of his labors, and if they respond to his appeal, in the nature of things, real and mutual obligations arise.

On the part of the inventor, it is claimed he should be prepared to demonstrate the truth and "practical novelty" of his results, because he is seeking from the public something to which he has no right unless he can prove these qualities to exist in what he offers to their consideration, this proof constituting his title to a right of property in these results. In other words, the writer would not have a patent granted, as it now is, upon novelty, but upon novelty and utility combined. With a view to ascertaining the extent of this "practical novelty," he would have all inventions submitted to a "competent authority," presumably some board of experts, who would examine and certify as to results. If the invention proved on trial to be practical and useful, it would be favorably reported for the grant of a patent; if not, it would be recommended that none be given.

We refer to this matter at length because it is not by any means the first time it has been agitated. Some ten or twelve years ago a similar proposal was made in the English technical press, and attracted the usual attention which is drawn to a novel and radical scheme. It was shown to be altogether Utopian and impracticable, and the agitation died a natural death.

Such a scheme would be fatal in principle and impossible to operate. It would be fatal to the progress of invention, because many incomplete devices, which contained the germs of a valuable invention, would be refused a patent on the ground that they were not in their incomplete condition commercially useful. That very protection which at present makes sure to the inventor the earlier steps of his progress, and is an inducement to persevering effort, would be removed. If we were to erase from our own Patent Office records all inventions which, while they showed "novelty," would have failed to show "practical novelty," the residue would be a small one. The instances of inventions which have contained all the elements of practical utility in their first patent are comparatively rare. We think that Elias Howe's poor little baster plate sewing machine might have fared badly if submitted to a board of "examination and certification," especially if its members chanced to be interested in any of the hand sewing establishments of the day. Such, at least, is the teaching of history. And if the practical novelty, the commercial utility of the first Bessemer patents had determined their granting or rejection, we are afraid that expert opinion, necessarily more or less prejudiced, might have set back the steel industry for a full generation. The chief effect of such a scheme would be to discourage invention, especially among people of limited means and opportunities. Comparatively few would have the faith and courage to undergo the long years of toil which have often been necessary before the last detail which makes a device commercially useful has been worked out, and do this without receiving the protection and encouragement of the law. Under existing conditions, as soon as an inventor has put his device into its first crude operative form, he may patent it; and being so far secured, he

may proceed to develop it into a practical machine ready for the market. It is this early alliance of the law with the inventor which has made possible the splendid developments of invention and discovery which have marked the present century, and to sever this alliance by any such means as suggested above would be to discourage the inventive habit among the people, and place its rewards apparently out of reach.

But over and above the objections to this scheme of examination and certification of results on general principles, it would involve such vast operations as to be quite impracticable. The United States Patent Office has granted in a single year as many as 26,292 patents, and the powers of the large staff of examiners are necessarily taxed to the utmost in determining the question of novelty in such a vast number of cases. But if, in addition to the novelty, the Patent Office or any other board had to determine by test the practical utility of each invention, it can easily be seen that the cost and time required for such a work would render it altogether impracticable.

THE GEOLOGICAL SOCIETY OF AMERICA.

The ninth annual meeting of the Geological Society of America was held in one of the lecture halls of the United States National Museum in Washington, D. C., from Tuesday to Thursday, Dec. 29 to 31, 1896, inclusive. It was noted as being the largest and best winter meeting the society has ever held. Washington has become a center of attraction for all classes of scientists and especially so for geologists, since the establishment of the headquarters of the national geological survey here necessitates the residence of a numerous body of geologists in the city during the winter.

The society was welcomed by Dr. Charles D. Walcott, the director of the United States Geological Survey, who suggested the idea of having Washington as the permanent place of meeting, especially for the annual winter meeting. Prof. Joseph Le Conte, president of the society, also fervently approved of the suggestion, but no action was taken.

Since the report of a year ago the society has lost three names from its list by death. These members were Prof. Robert Hay, of the Kansas State and afterward of the United States Geological Survey, Charles Wachsmuth, the noted student of fossil crinoids, and N. J. Giroux. Appropriate memorials of these men were read at the first session of the meeting. Seven new members were elected to the society, making a total of 240 fellows. This makes a net gain of ten in membership during the past year, which is very satisfactory, considering the continued financial depression. The chief feature of the meeting may be considered to be the presidential address. This was delivered by Prof. Joseph Le Conte, professor of geology in the University of California, whose name is well known throughout the country on account of his masterly text books on the science. His subject was, "The different kinds of earth crust movements and their causes," and he said in part:

Well nigh the whole drama of the forces at work on the earth is actuated by the sun, and all the phenomena of natural, physical, mental and social life arise from the same source. Igneous geological forces are the exception to this rule. There are, therefore, two groups of forces at work shaping the earth, the external or sun derived and the internal or earth derived. As an example of the former may be cited the agents of subaerial erosion, and of the latter, volcanic activity. The forces coming from the sun tend to reduce the inequalities of the earth's surface, whereas the others tend to increase the inequalities and accentuate the differences of level. The first set wears down, the second builds up.

As in biological science nearly the whole advance to the present time has been made by studying external phenomena, and the next advance must be made by intimate study of internal phenomena, so in geology much has been done by studying the forms produced by erosion and other external activities, but now attention is mainly devoted to the attempt to learn about the interior of the earth. Volcanoes and earthquakes are manifestations of grand internal crustal movements.

Internal or earth derived movements of the crust may readily be separated into four groups:

1. Primitive movements, by which oceans and continents have become differentiated.

2. Those by which mountain ranges have been made.

3. Oscillatory movements, or those which are not continuous in one direction.

4. Movements which have been determined by the transfer of load from one part of the earth's surface to another. This last group may not properly belong here, because the transfer is due to the sun. The loads referred to may be of ice or of sediment, and their transfer results in the vertical movement of great crustal blocks.

The forces of the first two groups are primary, continuous and cumulative, while those of the other groups are secondary and oscillatory and tend to hide or obscure what has been done by the first two.

Assuming that the earth was once an incandescent, fused spheroid of much greater size than now, had the material of which it was composed been homogeneous, the surface formed on solidification would have been even. Variations in density produced inequalities in the surface, the denser portions sinking. This factor alone would not have produced great depressions, but the denser areas would be more conductive of heat than the lighter, which would act with the other to produce the beginnings of the oceanic depressions and the continental elevations. The primeval ocean may have been universal and the continued contraction of the crust would deepen the beds and separate the bodies of water by means of continents. The permanency of the relative positions of ocean basins and continental areas was first promulgated by the late Prof. J. D. Dana and the doctrine is now generally accepted. The mean depth of the ocean is two and one-half miles and the mean elevation of the land is one-third of a mile, so that the average inequality of the earth's surface is less than three miles. This is about $\frac{1}{1365}$ of the earth's radius and would be represented by a difference of $\frac{1}{8}$ inch on a globe two feet in diameter.

The portions of the fused globe which were to become land areas would be the first to crust over on solidifying, because non-conductivity would prevent transference of heat from the interior to the surface, and the bottoms of the ocean depressions, having higher conductivity, would retain a high temperature longer and would be the last to crust over. The suboceanic earth material to the center of the earth is denser than the subcontinental material in the ratio of the subcontinental area to that of the suboceanic area.

The second group of earth derived forces are those producing mountain ranges, and are manifested as lateral thrusts. The features of the earth's surface thus produced are permanent in their character. Objection has been made to the theory of lateral thrust on account of the alleged shallow depth of the level of no strain. The earth increases in temperature as we go down, conductivity also increases, and density grows higher as we approach the center of the earth. Initial temperature probably increased with depth. All these factors lower the level of no strain and result in practically eliminating it from the problem. The lateral thrusts then resulting from contraction due to cooling are potent factors in the formation of mountain ranges.

The third group of forces produce vertical oscillatory crustal movements, and their effects are shown by numerous unconformities in strata. An example of this group is the Colorado plateau. This was sea bottom from the carboniferous to the end of cretaceous time, receiving from 12,000 to 15,000 feet of sediments. At the end of the cretaceous this mass began to rise and is still rising, although it has already been elevated more than 20,000 feet. But unconformities beneath the carboniferous strata show that the region went through several great oscillations before that time. More recent and widespread were the oscillations which took place during and after the glacial period. These amounted to thousands of feet and affected large areas. These are examples of the commonest of the movements of the earth's crust, but the question of their cause is the most inexplicable problem in geology, and no glimmer of light has yet been thrown upon it.

The fourth group of movements are those caused by gravitative readjustments of the crust. This is the doctrine of isostasy as enunciated by Major C. E. Dutton and others. A continuous transfer of material from one place to another must eventually be attended by subsidence where great deposits are forming and by elevation where erosion is taking place, but we must not conclude from this that all subsidence is caused by sedimentation and all elevation by removal of material by erosion. Isostasy does not explain the formation of mountain ranges like the Appalachians, the Wahsatch, the Sierra Nevada, etc. Mountain ranges are not now as formerly supposed to have been made by one set of forces; they are thought to be the result of a combination of forces, and monoclinal uplifts join with others in their formation.

Prof. Le Conte's address was listened to by a large and appeciative audience, which nearly filled the lecture room of the Columbian University. The officers of the society for the ensuing year are: President, Prof. Edward Orton, of Columbus, Ohio; vice-presidents, Profs. J. J. Stevenson, of New York City, and B. K. Emerson, of Amherst, Mass.; secretary, Prof. H. L. Fairchild, of Rochester; treasurer, Dr. I. C. White, of Morgantown, W. Va.; editor, J. Stanley-Brown, of Washington, D. C. The newly elected fellows of the society are: R. M. Bagg, E. H. Barbour, S. W. Beyer, A. P. Coleman, H. S. Gane, J. B. Porter, A. C. Spencer.

More than fifty papers, covering a very wide range of subjects, were presented at the meeting.

A NEW STEAMSHIP LINE.—The Belgian Steamship Company has made an arrangement with the Canadian government for the establishment of a fortnightly service of steamers between Antwerp and Canada.—Uhland's Wochenschrift.

The Overproduction of Books.

The enormous output of books in late years surprises everyone; few facts are more familiar, few are more commonly remarked, and few arouse such confusion of mind as to where they came from, why they exist, and how they find buyers and readers. In the year 1895 no fewer than 5,580 new books were published in England, besides 935 new editions of old books. In a single month the New York Times, to which we are indebted for these facts, has received more than 400 books for review.

The output is indeed so large that one might be tempted to infer that the proportion of books published to manuscripts offered for publication is becoming every year much larger than it formerly was. But the fact appears to be that this proportion, instead of changing in that way, is changing in the other direction. With all the increase in publications, there has also been increase in writing. Frederick Macmillan, at a recent dinner in London, stated that his house in one year had accepted only 29 books out of 315 that were submitted; while Mr. A. Chatto, in a published interview, affirmed that his house accepted an average of only about 13 for every 500 submitted.

Surrounded as we have been by a flood, we have, therefore, to thank the publishers that we are not in the midst of a deluge. Assuming that Mr. Macmillan's ratio is the ratio of all publishers, and provided all submitted manuscripts had been published, but excluding the unknown factor that the same manuscript was often submitted to several publishers, we should have had instead of 5,580 new books, 72,540; while the same computation, with Mr. Chatto's figures as a guide, would have given us 212,040 books, or nearly 700 for each day of the year, exclusive of Sundays!

The causes of this increase in the number of books are not far to seek. Cheapness of production—cheaper composition, cheaper paper, cheaper binding—is a great one, but a greater is the increase in the number of those who read. Popular education here shows some of the results of its work. But who shall say why 313 persons should continue to write books when only 29 can have them accepted, or why 500 should write them when only 13 can hope for acceptance? Is this also due to the spread of popular education and the resultant ambition to write?

The ability to write has become a common accomplishment; that is, the ability to write what is fairly grammatical. Scores of persons who write books which they hope to see published probably do not realize that something more than correct sentences is necessary. Provided they have a subject, with some knowledge of it, all that remains necessary from their standpoint is to write correctly. They do not know that correct writing no more makes a good writer than correct use of mechanics' tools makes an architect. No mere grammarian ever was an artist in words; indeed, the greatest artists in words have sometimes not been grammarians at all.

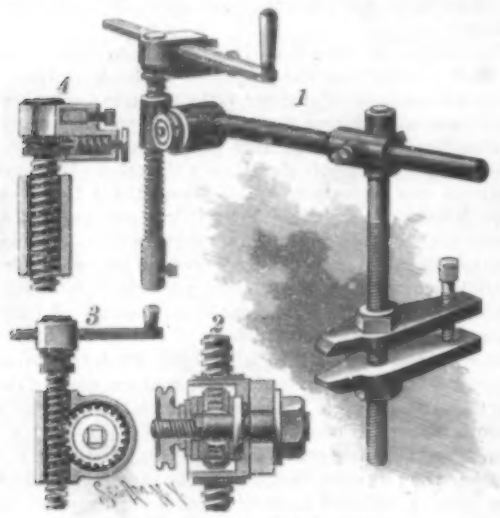
The future probably holds for us little hope that the number of books will decline; on the contrary, they are more likely to increase in number with the years. But we need not despair; despair remains only for the librarians—for Mr. Spofford and Dr. Billings. The great public will be protected, for the good books will live, and the bad ones will surely die—and the death will be a natural one. There were millions of houses in the ancient world, but only one Parthenon. Italy has had millions of buildings, but the Pantheon, St. Mark's, and St. Peter's still stand, as they will stand for some ages longer. We may get our 5,000 or our 10,000 books each year, but it will still remain true that not more than one really great book can be produced in a century or so. Europe waited several centuries to get her Dante, her Shakespeare, her Moliere, her Cervantes. Meanwhile, with the second great ones came whole regiments of lesser men, who had their brief reward, and then went each his silent way, book in hand, into the unknown beyond.

What a Pennyworth of Gas Can Do.

In a lecture recently delivered at the Royal Victoria Hall, London, says the Practical Engineer, Prof. Carlton J. Lambert stated that 37 cubic feet of gas, which is valued at one penny (two cents), and weighs about 1¼ pounds, can generate about 1 pound of water when burned, and about 19 cubic feet of carbonic acid. It can heat 30 gallons of water from 50° to 110° for a bath, or it can boil 8 gallons of water in good kettles, and make tea for 64 persons. It can work a 1 horse power gas engine for one hour, or lift a weight of 88 tons 10 feet high, doing the work of six men for one hour. It can melt 10 pounds of iron, and make a casting in 20 minutes, which ordinarily would require two hours and 30 pounds of coke. It can braze a metal joint in two minutes, which would require 20 minutes in a forge. If burned in a 6 inch flue for ventilation purposes, it can induce 80,000 cubic feet of pure air. It can give you a brilliant light (Welsbach incandescent) of 50 candle power for nine hours. It can, in a good radiating stove, comfortably warm a room 16 feet square for an hour. It can easily cook a dinner for eight persons.

AN AUTOMATIC FEED HAND DRILL.

In the tool shown in the illustration the feeding of the drill spindle is automatically regulated, according to the nature of the metal being operated on, and a universal adjustment of the drilling tool is obtained. The improvement has been patented by James McSweeney, and is being introduced by the E. D. Jones & Sons Company, of Pittsfield, Mass. Fig. 1 represents the tool complete and Figs. 2, 3 and 4 are transverse



McSWEENEY'S HAND DRILL.

sectional and side views. It is fastened to a table or other support by a suitable clamp, and has a threaded post engaging with its upper reduced end a collar forming part of a head having a second collar extending at right angles to receive a supporting rod, both the head and the rod being conveniently adjustable. On the outer end of the rod is a transverse bolt provided with a collar fitting into a recess of a casing, the bolt also having a lug engaging another recess preventing the casing from turning on the bolt, but permitting the latter with the casing to turn in the rod on slackening a nut. The casing has a bearing for a spindle having a drill socket at its lower end and handle at its upper end, the spindle being provided with a worm thread in mesh with a worm wheel turning loosely on the bolt within the casing, as indicated in Fig. 2. The inner and outer faces of the worm wheel abut against washers of fibrous wood or leather, which may be screwed up with more or less force to retard the turning of the worm wheel and insure a faster or slower turning of the tool-carrying spindle, which slides loosely in its bearing except as engaged by the worm wheel, the spindle turning it or rolling off on it, according to the resistance against the drill held in the socket or the retarding power of the worm wheel, owing to the action of the washers against its faces. The handle of the spindle is fitted with a casing, in which are adjusting devices, which may be arranged so that the operator, by turning the crank arm in one direction, can give a forward or a backward turning motion to the spindle, or by a forward movement of the crank arm will turn the spindle in one direction and by a rearward movement turn it in the opposite direction.

Shop Drawings.

It may appear as a curious fact, says Cassier's Magazine, that many men who have had years of experience in shops, and who are good workmen, seem to be afraid of drawings. While working to them with accuracy, and finishing their jobs satisfactorily, they never seem quite at rest in regard to the meaning of their drawings, and frequently remark: "If I had another job of the same kind to do I could get through it in much less time." This means, practically, that if they had a model before them instead of a drawing they could turn out their work more easily. It raises the question, too, whether it would not pay to give more attention to making drawings plain and to teaching the men to read them. Shading of parts and increasing the pictorial effect in general, so as to make one piece stand away from another, would seem to be a good thing, and in this respect some of the older forms of shop drawings might well be taken as examples worth following. To-day many of these out of date drawings are considered as having been wasteful of drawing office time, and uselessly elaborate, and yet they have good points. They told their story in a way quite foreign to the modern blue print.

Increased Use of Homing Pigeons.

The use of homing pigeons as messengers is said to have received considerable attention at the United States Naval Academy, at Annapolis, and, according to the New York Times, the government has recently established messenger pigeon stations at all the principal navy yards on the Atlantic and Pacific coasts, which have been organized as the result of satisfactory experiments made at the Naval Academy. Many newspapers use pigeons as messengers with decided advantage for the transmission of news, and so some of the recent election returns were brought in by carriers. Improvements in method and apparatus follow the new uses of the birds. The old way of attaching a quill with the message to the tail feather of the homer has been improved recently by an invention of Prof. Henri Marion, of the Naval Academy, a small water tight aluminum message holder, weighing less than eight grains, which can be fastened to the pigeon in an instant.

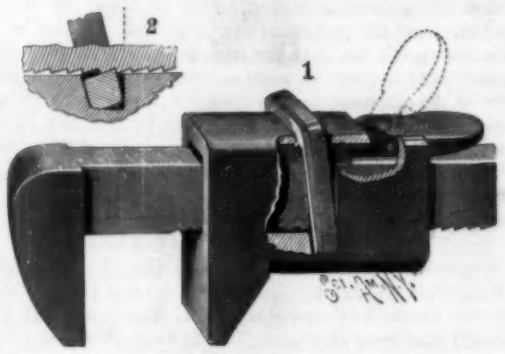
A TRACTION ENGINE BOILER EXPLOSION.

It is not often that one sees a more graphic picture of the rending effects of a boiler explosion than that shown in the accompanying cut. The excellent photograph of the remains of the traction engine—which latter, we are told, bore the name of Minnesota Chief—was taken by Mr. W. C. Gibbon, of Scotland, South Dakota, to whom also we are indebted for the particulars. The Minnesota Chief, which was a common farm traction engine, fell a victim to a foe which has laid low many a good traction engine before it—low water in the boiler. It seems that at the time of the accident the engine, which was on its way from one farm to another, became "stalled" in passing through a ravine. Presumably the engineer and fireman in charge tried to push their way through with the aid of an extra steam pressure, for, in response to the warning of a certain "mechanic and engineer" who "came to their aid and told them they would blow her up," the engineer "got on top of the boiler to open the safety valve." It was just at this critical moment that the boiler exploded, with the result that the engineer and fireman were blown to distances of 65 and 55 feet and instantly killed, the third party being blown to a distance of 30 feet and so badly scalded that he died three days later. The cylinder and steamchest were thrown 150 feet away, and will be noticed lying in the background of the picture; moreover, portions of the wreck were found fully a quarter of a mile distant. The driving wheels were wrenched off, the firebox blew out, nearly the whole of the cylindrical boiler shell stripped off, and altogether a more complete wreck was made than we remember to have seen in any previous locomotive or traction engine explosion.

A TRACTION ENGINE BOILER EXPLOSION.

AN IMPROVED WRENCH.

The illustration represents a wrench adapted for convenient adjustment with one hand, the movable jaw being quickly and firmly locked to the shank of the wrench at any desired point. The improvement has been patented by Lewis L. Hall, of Bourne, Oregon. Fig. 1 represents the tool complete, with a portion of the sleeve integral with the sliding jaw broken out, to show the engagement of a locking link with teeth on the under side of the shank, which is shown also in Fig. 2. The locking link has a rocking movement around the shank of the wrench, in suitable slots in a



HALL'S WRENCH.

sleeve of the sliding jaw, and between the back of the shank and the sleeve is an adjusting bar, by the forward movement of which the locking link is given its locking position. The adjusting bar is moved by a lever pivoted near the rear end of the sleeve, and when the lever is carried upward, as shown in dotted lines, the sleeve and its connected jaw slide freely up and down the shank, but when the lever is parallel with the shank, as shown in full lines, the sleeve and jaw are firmly locked to the shank of the wrench.

The Most Expensive Product in the World.

As a matter of curiosity, says Consul Morris, of Ghent, November 12, 1896, I forward the following translation of a statement recently published in European newspapers showing the article which, it is claimed, sells at the highest price in the world:

What is the most expensive product of the world, inquires Mr. Wilfrid Fonvielle? He answers, It is charcoal thread (filament de charbon), which is employed for incandescent lamps. It is, for the most part, manufactured at Paris and comes from the hands of an artist who desires his name to remain unknown in order to better protect the secret of manufacture. It is by the gramme (15½ grains) that this product is sold at wholesale. In reducing its price to the basis of pounds, it is easily found that the filaments for lamps of 20 candles are worth $8,000 per pound, and that for lamps of 30 candles they are worth $12,000 per pound. The former have a diameter of twenty thousandths of 1 millimeter (1 millimeter = 0·0394 inch) and the latter four and one-half thousandths of a millimeter. The filaments for lamps of 3 candles are so light that it would require nearly 1,500,000 of them to weigh a pound. As the length of each of them is 10 centimeters (3·937 inches), their total length would be 187 miles.

A PROFESSIONAL gardener says that red spiders on plants are always a sign that the atmosphere is too dry, and to get rid of them the plants must be showered every day with water. The scales, however, that are found on many hard wood plants should be taken off with the finger nails, after which the plants should be sprayed with a kerosene emulsion, which is made by dissolving two ounces of any good, hard soap in half a pint of boiling water, and adding to it a pint of kerosene, a little at a time and stirring continually. When you have a smooth emulsion, add two gallons and a half of warm water and mix well.—N. E. Lumberman.

WATER WHEEL REGULATION.

The Tuolumne County Electric Power and Light Company has recently installed a three phase transmission plant in Sonora, Cal., which contains several interesting features not found elsewhere. The apparatus used is of the General Electric tripbase type, and in addition to lighting the towns of Sonora and Columbia, the company is furnishing power to the Rawhide mine. It is in this mine that a 150 h. p. induction motor has been installed for operating the main hoist. The speed of the motor is controlled by means of a special regulator resembling in outward appearance the latest type of General Electric street railway controller, and consisting of commutating devices by means of which the direction of the motor is controlled and of suitable contacts for cutting equal resistances simultaneously into the three leads of the motor.

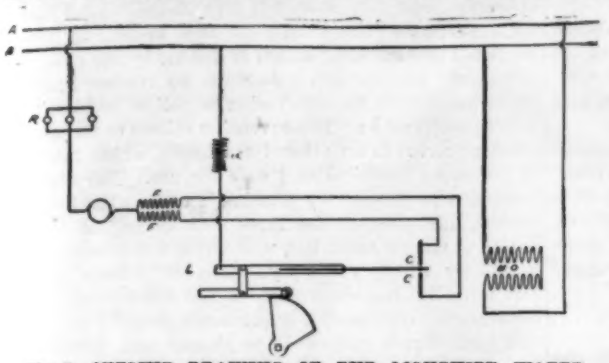


Fig. 2.—OUTLINE DRAWING OF THE LIGHTHIPE WATER WHEEL GOVERNOR.

The generating station is operated by a 48 inch Pelton water wheel running under a head of over 900 feet, and as the keynote of success in the operation of this plant rested in securing the very close regulation of the water wheels, it was determined to depart from the usual types of water wheel governors to satisfy the demands. Accordingly, Mr. J. A. Lighthipe, chief engineer of the Pacific Coast office of the General Electric Company, designed the electric governor illustrated herewith, to meet the exigencies of the case. This governor, which is the first one built, has now been in operation for several months with such success that steps are being taken for its installation in other plants where trouble is being experienced in the governing of water wheels operating under high head.

In principle, the Lighthipe governor consists essentially of a series motor with a double wound field; that is, a field containing two independent windings, each connected in series with the armature in such a way that while the direction flow in the armature is always one way, the polarity of the field is changed according to which of the two field windings is used. To the armature shaft is direct connected a screw carrying a traveling nut which moves backward or forward according to the direction of armature rotation, and by the nut is operated a rod which in turn controls a crank operating the hood or other means of regulating the water supply. From the main shaft of the water wheel is driven a centrifugal governor by belting, and this governor actuates the motor circuit through one or the other of the field windings.

The troubles heretofore experienced in the governing of water wheels have been due to the slowness of the pawl method of actuation and to the fact that "seesawing" is caused by the action of the governor in continuing to deflect the nozzle to a greater extent than that necessary to reduce the power of the wheel to the desired point. The nozzle, therefore, goes over the center as it were, resulting in the speed of the wheel falling below normal, which the governor attempts to correct, and, in doing so, pulls the nozzle back over the center again, giving excess speed. The process is again repeated and the "seesawing" is under full sway, to the utter defeat of satisfactory operation.

The means by which the Lighthipe governor obviates these two troubles will be understood by reference to the accompanying illustrations, from which it will be seen that the fanlike disk operated by the crank attached to the traveling nut on the extension of the armature shaft controls the elevation of a lever that is parallel with and secondary to the governor lever. This disk constitutes a cam of varying radii, as shown in exaggerated form in Fig. 2, and is so adjusted that as soon as the circuit of the pilot motor is closed by the governor lever the movement of the cam by the traveling nut raises or lowers the governor lever in such a way as to break the contact before the water wheel has been brought to the desired speed, thus compensating for the inertia of the moving masses and endowing the governor with a mechanical perception of far greater sensitiveness than that heretofore attained.

The diagram appended hereto as Fig. 2 will make clearer the electrical connections and operation of the governor:

A A are the mains from the exciter or other source of direct current supply.

R is a lamp resistance to reduce the current rush on closing the circuit.

F and F are the field coils wound in opposition, and constitute the device for securing reversal with only two contact points.

L is the lever operated by the centrifugal governor.

C and C are the contact points lying within the pole pieces of the blowout magnet, B O, which was added to break the destructiveness of the arc at the contact points.

B is the brake solenoid in series with the motor circuit and arrests the momentum of the armature by bringing it to an instantaneous stop upon breaking the motor circuit.

The governor is exceedingly sensitive and may be adjusted to any desired degree of sensitiveness by adjusting either the contact points, C C, or the link forming the fulcrum between the governor lever and the cam lever, shown in Fig. 1. The contact tips may be adjusted to within $\frac{1}{16}$ of an inch of contact, so that the slightest change of speed will throw the motor into action one way or the other. The ingenious mechanism accomplishes a closeness of regulation heretofore unattained; and while designed primarily for the control of water wheels driving electric generators, it may be used with equal satisfaction in any class of work, as the governor can be operated from a simple battery circuit, as well as from an exciter or an incandescent lighting service. We are indebted to the Journal of Electricity for the cut and particulars.

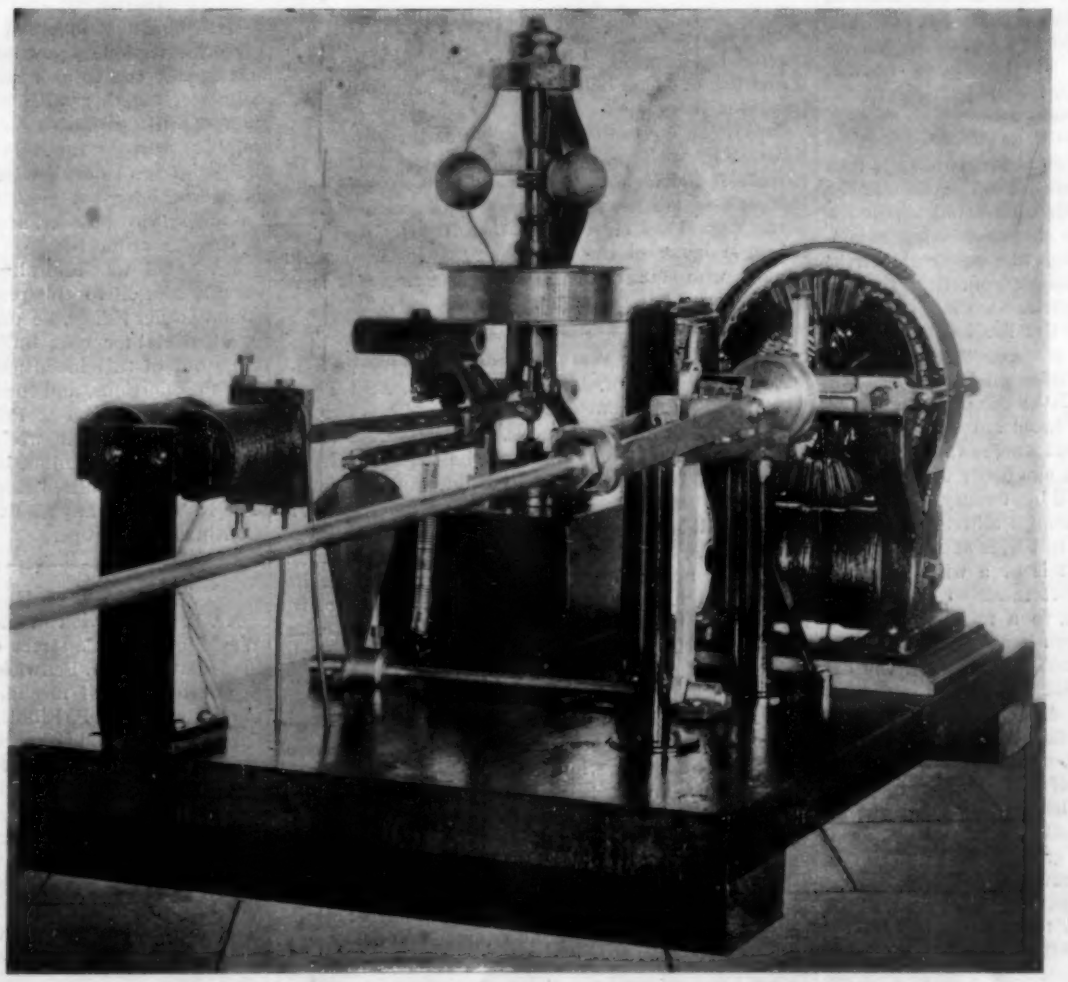
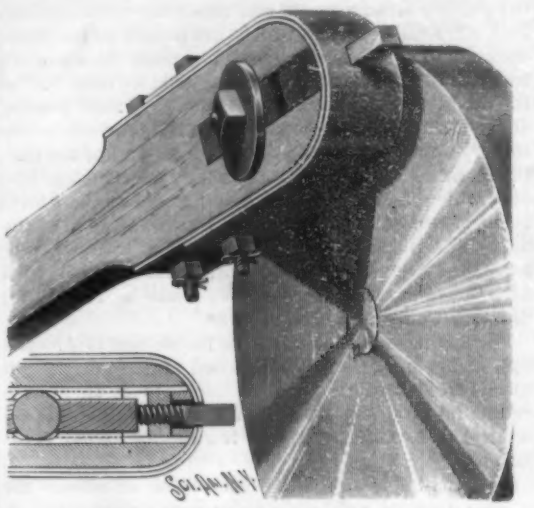


Fig. 1.—THE LIGHTHIPE WATER WHEEL GOVERNOR.

ELECTRIC power for drawbridges is to be adopted for all the bridges over the Chicago River, at Chicago, Ill., replacing the steam plants now required for each bridge.

AN IMPROVED PITMAN.

A pitman of simple and durable construction, with which all wear and lost motion may be readily taken up, insuring at all times a proper transmission of the motive power, is represented in the accompanying illustration and has been patented by John S. Nichols, of Storm Lake, Iowa. The pitman head has a longitudinal slot in which is a pitman box preferably made in two sections, engaging the crank pin on the crank disk, and the box sections are held in place transversely by longitudinal keyways. The outer end of the outer box section, as shown in the small sectional view, is engaged by a screw to prevent longitudinal movement, the screw screwing in a nut sliding in the slot and being prevented from turning in the head by its sides fitting against the sides of the slot. The screw also passes through a washer against which abuts the outer face of the nut, the washer abutting against a strap extending around the head and secured thereto by a bolt. The square head of the screw passes loosely through this strap, but is engaged by an outer strap also secured in place by a bolt, and the latter strap must be removed when it is desired to turn the screw to take up the wear of the box sections. The inventor has also devised an improved construction according to which the pitman blocks may be held in a light and solid malleable iron frame, and a crank disk and pitman thus connected are designed to run noiselessly and without any lost motion.



NICHOLS' IMPROVED PITMAN.

Manufacture of Woad.

The use of woad as a source of indigo is now very limited, says Nature, and most people probably imagine that it died out a thousand years ago or more. Woad appears, however, to be employed yet by some old-fashioned Yorkshire dyers, who use it in conjunction with ordinary indigo, in the so-called "woad vat." Francis Darwin and R. Meldola have recently visited an English woad mill where a primitive method of manufacture is yet conducted. At Parson Drove, near Wisbech, the leaves of the plant (Isatis tinctoria) are wrenched off at the base by the pickers, the root being left undisturbed so as to permit the growth of a second crop. The first process consists in crushing the leaves to a pulp under three hollow wooden rollers, round the circumference of which about two dozen iron cross bars are arranged to serve as effective crushing edges. The resulting pulpy mass is kneaded by hand into balls which are then placed on wooden trays to dry in open sheds. When dry they are again ground up under the rollers, and the crushed material is allowed to ferment after sprinkling with water. This final stage completed, the woad is ready for market. The object of first drying the pulp and then wetting it again before fermentation is not obvious, but the fermentation itself is probably a zymolytic decomposition of glucosides.

A RAILWAY THROUGH THE SEA.

(Continued from first page.)

son. On the car are two 30 horse power motors of the G. E. 800 type, which have been supplied by the British Thomson-Houston Company. The motors are placed vertically over two of the main legs, the armature being connected through bevel gearing to a vertical shaft, which at the bottom is geared through bevel wheels and single reduction gearing on to the axles of the wheels. A reference to plan and section of the gearing arrangements will make the working clear. The controlling devices which are placed on the main deck are very similar to what one finds on a modern tramcar, a G. E. controller being fixed at each end of the deck; the brakes are operated by rods passing down the two unoccupied legs. The generating machinery is erected at the Rottingdean end of the line, the plant being located on a specially constructed iron pier, which serves also as a landing stage; piers have been, of course, rendered necessary at each end of the line. The plant consists of a General Electric Company four-pole railway generator, direct coupled to a high speed double acting engine, made by Messrs. W. Sisson & Company, of Gloucester.

The engines have cylinders 7 ¼ inches and 13½ inches by 7 inches stroke, and are designed to give a maximum speed of 550 revolutions, developing 110 B. H. P. as a maximum; but it has been found that ample current is developed when the engine is running at 525 revolutions.

The engine is supplied with steam at about 120 pounds, through a reducing valve from a marine return tube boiler, W. P. 150 pounds. The object of this arrangement is to allow for the large fluctuation of work, and to permit the boiler to act as a reservoir by means of increase of pressure, and at the same time a heavy draught of steam occurring through sudden and large increase of load is less likely to cause priming.

In the engine house is a switchboard on which an automatic circuit breaker and the usual measuring instruments are arranged. An electric current of 500 volts pressure is delivered direct into the overhead wire, which is suspended partly on steel and partly on wooden posts. At low tide the return is by the rails, and at high water the sea is used, which calls, however, for no special bonding.

We believe the total cost of the line is about $150,000, this sum, however, including the construction of the two piers. Mr. St. George Moore has been the consulting engineer in the undertaking. The severe gales in the early part of December resulted in the complete wreck of the car, the destruction of one of the jetties, and great injury to the track. The damage inflicted by the storm amounted to more than $20,000. The railway had only been opened a week. For our engraving we are indebted to the Illustrated London News, and to Electrical Review for the particulars.

Chicago Main Drainage Canal.

The Chicago Main Drainage Canal, which is now nearing completion, will always be celebrated for the vast amount of machinery for excavation which has been designed and successfully operated during its construction. American ingenuity has never shown itself to better advantage. We have from time to time given some details of this important work, and we will merely recapitulate a few of the leading facts: The canal is being built for the purpose of carrying the sewage of Chicago into the Mississippi River. It is designed so that the waters of Lake Michigan will flow through it at the rate of ten thousand cubic feet per second, and it is expected that the sewage will be so diluted that no possible harm can occur to the towns by which it will flow. It will be twenty-eight miles long, and where it passes through alluvial ground it will be two hundred and two feet wide at the bottom. The material to be taken out is of a widely varying character, ranging from a soft mud, so soft that it can be taken out by pumps, to a mixture of sand, gravel, clay and bowlders which is cemented so firmly as in some cases to require blasting. Much of the excavation, also, is through solid rock. The estimated quantities to be removed are 4,500,000 cubic yards of wet soil, 23,000,000 cubic yards of alluvial and hard soil, and 12,000,000 cubic yards of solid rock, making a total of 39,500,000 cubic yards of excavation.

The excavation of the soil has been carried out almost entirely by the use of steam shovels, the material being carried to the dumping ground by some form of inclined plane or by continuous belts or conveyors. When the material had to be carried farther than 1,000 feet the locomotive was found to be more economical than the stationary engine. After the rock had been blasted, it was taken out by stationary cable inclines, by traveling cable ways, or by cantilever hoists. The traveling cable ways, of which there were nineteen in all, consisted of two wooden towers running on trucks upon the banks, the space between the towers being about 700 feet. Buckets were lifted to the main cable, drawn along and dumped at the sides. The main cable was 2¼ inches in diameter and the buckets were capable of holding about 2 cubic yards of rock. The cantilever crane consists of two connected cantilevers carried on a tower which is arranged to travel upon a track at the side of the canal. The trusses are inclined at 12½°, one arm of the crane projecting over the cutting while the other extends upward over the dumps. The buckets can carry 1¾ cubic yards, and they are suspended from a car which runs along the crane, and is worked by a hoisting engine on the car. This machine can handle about thirty buckets an hour or two hundred and twenty-five loads a day. Perhaps the most effective machines of all were the hydraulic dredges. These were provided with suction pipes which carried vertical telescopic joints and a revolving cutter, which loosened the material at the bottom of the pipe so that the pump could bring it up. The dredger is swung backward and forward by means of ropes attached to the bank.

The excellence of the excavating machinery is shown by the fact that, of the vast total of nearly 40,000,000 cubic yards, the earth is being taken out at a cost, including the contractor's profit, of 29 cents per yard, and the solid rock for 77 cents per yard.

When the long talked of Nicaraguan Canal comes to be built, it will feel the benefit of the magnificent plant which has been designed for the Chicago canal. It is only in the possibility of handling huge earth and rock quantities quickly and at small cost that the great undertaking has any promise of being carried through.

Explorations in Central Asia.

The scientific expedition of M. Clementz, under the patronage of the Russian Imperial Geographical Society, left Urga, in Chinese territory, on May 24, 1895, to explore Mongolia. In June, 1896, they ascended the Otkhon-Tengre, the highest peak of the Hangai range, up to 13,000 ft. or 14,000 ft. above sea level.

Dr. Sven Heding, the Swedish explorer, left Kashgar on December 14, 1895, and made his way by Yarkand and Karghalik to Khotan. Starting from the latter town, he spent nearly five months in exploring the surrounding country, and discovered the ruins of two ancient towns. One of these, of vast size, contains some remains of monuments, the architectural style of which seems to indicate that they are of Indian origin. Then crossing the desert as far as the banks of the Kiria-Daria, the expedition fell in with a small nomadic tribe to the north of this river, so isolated from the rest of mankind that its members did not know whether Yakup Beg still existed or whether they belonged to China. Whole herds of wild camels were also met with, two or three of these animals falling victims to the rifles of the party. On reaching the extreme confines of the desert Dr. Sven Heding found a series of lakes and marshes, which in all probability covered the former bed of Lake Lob-Nor, though the formation of these lakes, as it would seem, only dates from nine years back.

Captain Deasy, of the 16th Lancers, who set out from Kashmir in April last on an expedition to explore the sources of the Mekong and Irawadi, has returned to Leh, in Kashmir, owing to deficiency of means of transport. Captain Welby, of the 18th Hussars, and Lieutenant Malcolm, of the Argyll and Sutherland Highlanders, who started at the same time, have, it is reported, arrived at Lan-chau.

How Much Water Should we Drink.

According to Prof. Allen, says The Medical Times, we should drink from one-third to two-fifths as many ounces as we weigh in pounds. Therefore, for a man weighing 168 pounds, there would be required fifty-six to sixty-four ounces daily, or from one and one-half to four pints. This The Journal of Hygiene regards as a very indefinite answer. The amount of water required depends on the season of the year, the amount of work done, and the kind of food eaten. In hot weather we require more than in cold, because of the greater loss through the skin, though this is in part made up by the lesser amount passed away through the kidneys. If a man labors very hard, he requires more than if his labor is light. A man working in a foundry, where the temperature is high and the perspiration profuse, not infrequently drinks three or four gallons daily. If the food is stimulating and salty, more water is required than if it is bland. Vegetarians and those who use much fruit require less water than those who eat salt fish and pork, and often get along on none except what is in their food. In most cases our instincts tell us how much water to drink far better than any hard or fixed rule. For ages they have been acquiring a knowledge of how much to drink, and transmitting that knowledge to descendants, and if we follow them we shall not go far out of the way. It is of more use to us to know that pure water is essential, and that impure water is one of the most dangerous of drinks, than to know how much of it is required daily. If one lives in a region where the water is bad, it should be boiled and put away in bottles well corked in an ice chest, and in addition, one should eat all the fruit one can, if fruit agrees. Fruits contain not only pure water, but salts which are needed to carry on healthfully the functions of life.

Alfred Nobel.

The scientific world in general and the engineering world in particular has lost a conspicuous member in the death of Mr. Alfred Nobel, the distinguished Swedish engineer, which occurred recently at San Remo, Italy. It would be difficult to find anything which has done more for the world of civil engineering, especially as it is concerned with large and heavy earthworks, than the great variety of explosives which owe their existence directly or indirectly to the genius of Mr. Nobel. In the year 1847 Sobrero discovered that by acting upon glycerine with a mixture of nitric and sulphuric acids a highly explosive substance was formed. Nobel was the first to make use of this liquid in its original state; but it was extremely dangerous in operation, and very soon fell into disuse. After careful experiment, the author of this sketch, in 1864, patented an explosive, which is known by the name of dynamite, and in this substance he rendered nitro-glycerine safe for transportation as well as for blasting.

His patent says: "The invention relates to the use of nitro-glycerine in an altered condition, which renders it far more practical and safe for use. The altered condition is effected by causing it to be absorbed in porous, unexplosive substances, such as charcoal, silica, paper, or similar materials, whereby it is converted into a powder which I call dynamite, or Nobel's safety powder. By the absorption of the nitro-glycerine in some porous substance it acquires the property of being in a high degree insensible to shocks, and it can also be burned over a fire without exploding."

The substance commonly used for absorbing the nitro-glycerine is an infusorial earth. Mr. Nobel erected very extensive works at Ardeer, in Scotland, which for many years were the chief source of supply for the new explosive.

Following upon the invention of dynamite came the gelatine explosives, in which a soluble form of gun-cotton or nitro-cellulose is dissolved in nitro-glycerine. The first patent for this kind of explosive, which was known as blasting gelatine, was taken out by Nobel in 1875. This explosive was stronger than dynamite in the relation of 1·4 to 1. Nobel subsequently took out patents for various mixtures of blasting gelatine with wood pulp, nitrate of potash, etc., which are known as gelignite, gelatine dynamite, etc., and these later compounds have almost entirely taken the place of dynamite for general blasting operations.

It is estimated that there are considerably over one hundred different kinds of dynamite to-day whose base is derived from nitro-glycerine, and all of these are derived from Mr. Nobel's original dynamite, or from blasting gelatine.

Mr. Nobel next invented ballistite, first of the nitro-glycerine smokeless powders. This was composed of a mixture of the soluble and insoluble forms of nitro-cellulose, together with nitro-glycerine, the composition of this explosive being now given as one-half soluble nitro-cotton and one-half nitro-glycerine. Ballistite is of darkish brown color and usually is made in the form of small squares. It is used in Italy as the service powder, and it has a good reputation among the artillerists.

Mr. Nobel was a prolific inventor, and he did not confine himself to the production of new explosives. Among other things, he experimented with aluminum as a material for boat building. The industry which grew out of this invention has assumed exceedingly large proportions, and the factories of the Nobel Company, at Ardeer and at Polmont, are spoken of as being the largest in the world, a great variety of explosives, such as dynamites, blasting explosives, and both ballistite and cordite, being extensively manufactured. The Nobel Company also own several factories on the Continent of Europe.

Death of R. W. Fenwick.

Mr. R. W. Fenwick was stricken with apoplexy in a Washington, D. C., street car on December 28, dying immediately. Mr. Fenwick, when sixteen years of age, began the study of mechanical drawing and engineering with William P. Elliott, the architect of the Patent Office. He studied the patent business in the offices of Munn & Company, and eventually became the manager of the Washington branch. In 1861 he started a patent law and soliciting business of his own. He was associated with Judges Lawrence and Mason. In his long practice Mr. Fenwick had charge of many important cases and he was an acknowledged authority upon the history of patent laws. When the centennial of the American patent system was celebrated, he was chairman of the committee of arrangements. He also held important civic offices.

Capt. Mahan Retired.

Capt. Alfred T. Mahan, U.S.N., who is known as one of the foremost writers of the world on naval topics, has been placed on the retired list of the navy at his own request, under the law permitting retirements after forty years' service. Capt. Mahan desires to devote his entire time to the literary work in which he has been so successful.

Correspondence.

A Much Needed Invention.

To the Editor of the SCIENTIFIC AMERICAN:

"There is no great loss without some small gain." Panics like that which the American people have recently passed through teach them the wisdom of economy. In fact, the poor and middle classes of this country are just beginning to practice the economy which is so prevalent in Europe.

One of the directions in which great economy might be brought about is that of tobacco smoking. We are a smoking people and spend millions of dollars annually in the satisfying of this appetite. The satisfaction obtained from cigar smoke might be obtained from pipe smoke for about one-tenth of the cost, and every old smoker knows that there is more "solid comfort" in a pipe.

Persons desirous of giving up the cigarette habit find it much easier to give it up for a pipe than for cigars. The one great obstacle in bringing about this vast economy and reform in smoking lies in the fact that few persons can smoke a pipe with comfort on account of its irritating or "burning" effect upon the tongue. If some one could invent a pipe which would prevent this, and which could be easily cleaned, he would secure for himself an independent fortune and for the smokers of the world a legacy worth untold millions.

AN OLD SMOKER.

Nickel Steel.

BY H. K. LANDIS, AM. INST. MG. E.

Although it was but a decade ago that this formidable alloy actually entered into competition with other high resistance metals, its existence was known in the latter part of the eighteenth century. In 1792 Christoph Gertanner said that "iron combines easily with nickel;" Faraday produced a nickel-iron alloy in 1820; Berthier, Fairbairn, and others also studied this interesting alloy. The first industrial application, however, was made by Wolf, a record of whose work will be found in the annals of Liebig of 1832. He produced from nickel-iron alloys beautifully embossed articles which are said to have been of superior excellence. In 1853 the attempt was made in the United States to make the nickel-iron alloys directly in a blast furnace, but the effort was not commercially successful, for the reason that the product had no constant composition, and that there was no commercial demand for it. It remained for the naval authorities at Washington to give the required impetus. Tests made both in Europe and this country demonstrated the toughening effect of nickel upon steel, and it was agreed that this alloy should be tried on the armor plates already contracted for, the government paying for the nickel consumed, and that the steel should contain 3 per cent of nickel. Commercial nickel steel contains 2 to 5 per cent of nickel. It was found that these heavy armor plates, destined to protect the sides and barbettes of our war vessels, were very superior to the ordinary steel plate, not only in the ballistic tests but also that they withstood the strains in heating, forging, and tempering very much better. Thousands of tons of nickel steel have been employed for this purpose alone, forming a nucleus about which the alloy has grown, until it emerged from the experimental stage as the "noblest Roman of them all," and to-day stands first among high specification steels.

Iron has a strong affinity for nickel, and alloys with it in all proportions very readily. It seems, however, from tests given further on, that the maximum results are obtained with 8 or 16 per cent of nickel. The following is the average composition of nickel steel as made in the United States:

Carbon	0·24-0·28 per cent.
Sulphur	0·02-0·03 " "
Manganese	0·60-0·70 " "
Phosphorus	0·01-0·03 " "
Nickel	3·00-5·00 " "

It will be seen that the above corresponds to what is called a "mild steel," and yet the increase in strength due to nickel alone is probably 60 per cent of its strength without the addition of nickel, while the cost of the steel is but 1 to 1·5 cents per pound more, disregarding the small loss in manufacture. Most of the nickel steel is made in the furnaces of the Bethlehem Iron Company and the Carnegie Steel Company, where it is cast into ingots weighing from 50 to 100 tons, requiring the charge of two or three furnaces to fill the ingot mould. The "stock" from which the steel is made is metal of known purity, wash metal, some pig iron, pigs of ferromanganese, "scrap" from previous "heats," crop ends from forgings, lathe and planer chips from the machine shop, and finally nickel. The latter is added after the charge is melted and a short time before casting, as the oxide or metallic nickel unites very readily with silicates in the slag, thus involving considerable loss. The method of adding nickel varies. The smaller losses occur with metallic nickel shot, which is used for alloys containing over 5 per cent of nickel. The usual method is to use oxide of nickel mixed with charcoal and lime, made plastic with water, moulded into cubical bricks and dried thoroughly. When added to the bath of steel, now at a white heat, the carbon of the mixture reduces nickel oxide to metallic nickel, lime taking up any silica that may be in the adjacent charge, thus insuring an immediate alloy and at the same time preventing loss of nickel by the formation of silicate of lime. As one stands upon the furnace platform or floor, shielded from the intense heat (the metal is at about 3,000° Fah.) of the liquid steel by a crane girder column, and sees the incandescent metal rush through the "tap hole," down the "runner" to the "ladle," amid the bustle of workmen and the sharp puffs of traveling cranes, his mind naturally reverts to the days of Tubal Cain or to the German myth Mime, thence to the first manufacture of Damascan cementation steel, and following the series he sees in his mind's eye the white sides of those splendid American battleships, which are the crowning triumph of that development which has justly earned for our era the title of the "age of steel." The furnaces employed are of the open hearth type, and consist of an oblong, horizontal metal pan lined with refractory brick and clay, whose vertical sides are provided with doors at the front and back, and "ports" at the ends, through which the combustible gases enter and take their exit after burning. An arched roof completes the structure, the capacity of which varies from 20 to 50 tons, being usually 40 tons. The method of manufacture does not differ much from that practiced with other steels, except that a small variation in the content of nickel makes but a trifling variation in the properties of the steel. Carbon is the principal component to be gaged, the nickel and manganese being added in the required proportion as alloys. These are added just before tapping to prevent their going into the slag; nevertheless the slag always has a green appearance, caused by the formation of silicate of nickel.

Physical Properties.—Resistance to corrosion is its principal peculiarity. Numerous tests have been made, especially in sea water, which is very destructive to iron or steel, the results of which have demonstrated the fact that nickel steel when used alone would outlast the best of ordinary steels. This was proved by tests with propellers, torpedo netting, metal sheathing for vessel bottoms, etc. There seems some doubt, however, as to its applicability to boilers, where its high elastic limit would permit much lighter construction. Some experiments indicate that nickel steel corrodes rapidly in pure water and in the presence of various boiler compounds, while on the other hand an English authority cites an experiment indicating a corrosion of but one-half to three-quarters that of ordinary steels. When the boiler is made entirely of nickel steel, thus preventing electrolytic action, there is no doubt but that it is the best material yet applied to that purpose. The fracture faces are more fibrous than in ordinary steel, though there is no appreciable difference in color or luster of the polished metal.

Mechanical Properties.—Nickel steel is a noble metal, for while it has a remarkable resistance to applied stresses, yet it is almost as easily worked as soft steel, is not brittle while hot or cold, is not much affected by tempering or annealing as compared with carbon steel, and is remarkably homogeneous. We might first ask what effect nickel has on the properties of iron. This was shown in the results of experiments on nickel-iron alloys made at the Laboratory of Industrial Mechanics at Berlin and reported by that celebrated metallurgist Dr. Wedding. These alloys contained no carbon and but small percentages of several impurities—not over 0·2 per cent total. The results were, therefore, practically for pure nickel-iron alloys, and they showed that the maximum tension results were obtained with an 8 per cent nickel alloy, while the compressive and shearing strength had its greatest development with the 16 per cent alloy. The effect of nickel on iron was therefore to raise its tensile strength from 52,500 to 80,200 pounds per square inch; its elastic compressive strength from 29,440 to 186,748, and its shearing resistance from 42,342 to 102,410 pounds per square inch. This effect is not obliterated by the presence of carbon, as is seen in the deductions arrived at by Cholat and Harmet:

1. Ferro-nickel alloys: 2·5 per cent nickel, 0·1 per cent to 1·0 per cent carbon.—The elastic limit and ultimate strength are raised and contraction decreased as the proportion of carbon increased. Tempering develops these properties uniformly.

2. Ferro-nickel alloys: 15 per cent nickel, 0·1 to 1·0 per cent carbon.—In the annealed specimens, strength and elasticity increased rapidly with the carbon content up to 3 per cent carbon, where the tensile strength was 213,400 pounds per square inch. Tempering in oil raised the elastic limit of this last steel to 166,400 and its breaking strength to 277,400 pounds per square inch. The minimum contraction corresponded very nearly to the highest elastic limit. Prolonged annealing slightly improved on the annealed specimen.

3. Ferro-nickel alloys: 25 per cent nickel, 0·1 per cent to 1·0 per cent carbon.—An interesting variation is here noted, for contraction and elongation rise with the carbon content, the tensile strength remains high, and the metal is not brittle. It seems that the high percentage of nickel held the carbon in a condition which could not be modified by tempering.

This latter property is very useful, as internal strains incident upon manufacture can be relieved by annealing without sensibly reducing the resisting qualities of the steel; in fact, such annealing tends greatly to toughen the material and increases its ability to resist shock or vibration to a remarkable degree. Where a low carbon (0·20 per cent C) steel will withstand 300,000 double stresses on an alternate stress machine, a high carbon (0·50 per cent C) will break at probably 400,000 and nickel steel at from 1,500,000 to 2,000,000 such double stresses, each stress being two-thirds of its ultimate strength, or very near its elastic limit. It is very common for tempered nickel steel to have a tensile strength of 200,000 pounds per square inch without being brittle. If we compare this with the 60,000 pounds for low carbon steel, we see that there is still plenty of room at the top, for most of the steel used to-day is low in carbon. Commander Eaton, U.S.N., says that our government first bought nickel to use in steel in 1890, that the first nickel steel plate was tested in 1893, in July, from which date all armor for United States vessels was made of nickel steel. As the armor plate industry has probably achieved the best results in nickel steel, the following tests made on plates exhibited at the Chicago Exposition by the Bethlehem Iron Company are presented. The analysis of this steel corresponds very closely to the average composition already given, except that the nickel content is 3 25 per cent.

MECHANICAL TESTS OF NICKEL STEEL ARMOR PLATES.

Elastic Limit. Pounds per square inch.	Ultimate Strength. Pounds per square inch.	Elongation. Per cent.	Contraction. Per cent.
86,000	142,000	11·50	45·0
72,000	117,300	14·25	45·0
96,800	120,000	13·75	62·0
78,800	110,000	16·25	58·5
64,000	117,600	17·00	45·9
65,000	118,900	16 66	42·2
74,000	142,800	13·00	28·2
74,000	143,200	12 82	27·6
51,000	91,600	22·75	58·2
51,000	91,200	21·72	58·4
53,000	85,200	21·90	49·5
48,000	86,000	21·25	47·4
.....	276,000	2·75	4·0
.....	246,600	4·25	6·0

When these results are compared with those of high carbon steel having a strength of 90,000 pounds per square inch, we can understand why simple steel plates break while nickel steel resists the ballistic tests. Low percentages of nickel do not interfere in the least with the ordinary processes of Harveyizing, tempering, forging or reforging, machining, or rolling, and give to the plates all the qualities of high carbon steel without its brittleness.

Outside of the application of this metal by the United States navy to armor, angles, rods, thin plates, engine shafting, hull plates, an experimental gun, the barrels of small arms, torpedo netting, etc., may be mentioned its application to bicycle frames and handle bars, steam boilers, and difficult steel castings. In fact, wherever a tough metal of high resistance and low corrodibility is wanted, this alloy is applicable. Its excellent mechanical qualities permit the weight of the parts to be reduced, leading to its application to motor carriages, flying machines, and suspension bridges, while its high resilience allows it to be used to advantage in car links, axles, crank pins, bridge pins, bicycle spokes, etc. We may look forward with a considerable degree of certainty to the extended use of this material in a wide variety of mechanical construction in the near future.

Swiss Exposition of 1896.

Consul Ridgely, of Geneva, reports, October 27, 1896: "The Swiss National Exposition, which was held at Geneva from May 1 to October 18 inclusive of last year, was conducted at a great financial loss. The confederation subscribed 1,000,000 francs and the city and canton of Geneva provided a guarantee fund of 500,000 francs. In addition, the exposition company issued 500,000 francs in stock, which was subscribed to by various patriotic citizens. All this has been swallowed up, and there is still an estimated deficit of from 100,000 to 300,000 francs, which is to be covered by the profits of a national lottery, to be drawn the last part of November. The financial failure of the exposition was due entirely to the spring, summer, and autumn of unprecedented bad weather. The exposition was inaugurated in a storm of wind and rain on May 1, and was closed on October 18, attended by the same unfavoring elements. During the entire season, there were only a few days of good weather, and the whole country became in consequence more or less dispirited. Thus it happened that Switzerland's greatest national industrial enterprise was a signal financial failure. In all other particulars, however, the exposition was a splendid success. The displays were thoroughly representative of the mechanical industry, as well as of the agriculture and art of the country, and were made on a scale of lavishness that would have done credit to a much larger and richer nation."

A School of Military Ballooning.

The School of Military Ballooning, under the charge of officers of the Royal Engineers at Aldershot, Eng., has done much to increase the practicability of balloon service in war, says the Army and Navy Journal. Steel tubes are used for carrying compressed hydrogen for inflation, and hydrogen of the purest quality is manufactured from zinc and sulphuric acid by electrolysis. These tubes are safe under a strain of 101 atmospheres. Three wagons are required to transport tubes carrying a charge of 11,000 cubic feet of gas, but new patterns, tubes and wagons have been adopted, which will reduce the transportation to two wagons. "Gold beater's skins" are used for the balloon, and they are so light that the balloon with 2,500 feet of surface and carrying 10,000 cubic feet of gas weighs only 170 pounds. The material is so strong that a closed balloon of large size has ascended 7,000 feet without bursting. The present material is not subject to the disadvantages of the varnished silk and cloth balloons of olden times, which were subject to cracks, became often overheated, were easily torn, and permitted the gas to leak away. The top valve of the balloon is now made very light and strong, of an aluminum alloy, and is perfectly gas-tight. The cords of the balloon are made of Italian hemp, a fine brass thread being woven into the cord for security in thunder storms. It weighs one pound to the hank, and will stand 500 pounds strain to the yard without breaking. The rings are of American hickory and the wickerwork of the car is excellent. Every balloon wagon has half a mile of wire rope attached to it which is available for holding the balloon captive. There is also a telephone conductor; and connection with the wagon is neatly made on a screw bar, so that in whatever direction the pull of the balloon may be the wire rope will never come into contact across the drum.

The London Standard, from which we obtain these particulars, says: "Some of the hand records taken in the free balloon excursions are extremely precise and full of serviceable details. The photographs, even those of small size, usually contain details of value. Soldiers within a range of two miles on each side of the line of flight can be detected with a hand lens. The coming trials of the capabilities of balloons for taking part in military engineering operations in warfare will be fraught with interest and novelty, whether they be successful or not. The first trials will probably be directed toward the application of captive and carrying balloons in assisting or preventing operations in trenches. The ditch forms the protection to the working sappers; and the artillery projectiles cut into the rear of the trench and drive the debris to the rear of the work. The object of a balloon attack, therefore, might be to plant, say, a 500 pound charge of high explosive in rear of the trench, so that when exploded it would blow the debris into it, overwhelming the men or exposing them to the enemy."

THE OPERATION OF THE SELF-BINDING HARVESTER.

BY E. J. PRINDLE.

It is marvelous how quickly the practical self-binding harvester has been produced. The young men of to-day can remember when the sickle was in common use for harvesting, at least on the smaller farms. The better equipped farmer had the cradle. Then came the form of harvester having a platform on which the grain fell as it was cut, and from which it was raked by an attendant when a proper quantity had accumulated. The harvester was followed by men who bound the bundles by hand. On some machines two men were carried who bound the bundles as they were formed. Improvements were steadily made until the first successful self-binders were produced, requiring four or six horses, and being unreliable to such an extent that it required the attention of several men to run them.

Fig 2.

And now we have harvesters cutting and binding automatically, easily managed by one man, and some of them so light that two ordinary horses can draw them. To the uninitiated they seem an unintelligible mass of intricate machinery. But like most machines, the principle is comparatively simple, even of that almost human contrivance the cord knotter. Fig. 1 is a transverse cross section of a self-binding harvester. The grain, as it falls from the sickle, is caught on the horizontal traveling belt, K, which carries it to the two inclined belts, L and M, between which it is elevated to the packer, B, which throws it against the cord. The cord runs from the twine box through the eye of the pivoted needle, or binder arm, D, and from thence past the knotter, U, to the holder, F, which clamps the end of the cord. The packer forces the grain into the bight of the cord until the trip arm, G, is forced back far enough to operate the clutch, which sets the cord knotter in motion. The needle is thrown up through the column of grain, carrying the cord by the knotter and into the holder. At the same time, the compressor arm, E, compacts the bundle between itself and the needle. There is now a loop of cord surrounding the bundle, and having its ends caught in the holder, the knotter being between the bundle and the holder.

To make the operation of the cord knotter clear, a series of photographs is reproduced, showing the same knot being tied by hand in the same manner. In Fig. 2 the general arrangement is shown. The twine runs from the ball through the holder, by the knotter, around the bundle and back to the holder, leaving a second strand passing the knotter, which is here replaced by two fingers of the hand. In tying the knot, the fingers sweep back, over the cord, Fig. 3, continue around in a nearly horizontal plane, Fig. 4, and separate so that one passes above and one below the strands of cord, Fig. 5. The fingers are then forced together, grasping the strands between them, after which they are drawn back, Fig. 6, carrying a loop of the two strands up through the circle formed by the previous motions of the fingers, Fig. 7. This completes the knot, as shown in Fig. 8.

The mechanical knotter, shown inverted in Fig. 9, consists of a fixed finger on a rotatable shaft, and a finger pivoted to the shaft and pressed against the fixed finger by a strong spring. The pivoted finger carries a friction roller, U', on its rear end and is raised as the knotter rotates by the action of this roller on a cam fixed on the frame of the machine. The fixed finger has a purely rotary motion, and when the knot has reached the stage represented in Fig. 5, the knotter simply holds the strands of cord, and the expulsion of the bundle draws the circle of cord over the fingers, thus having the effect of drawing the strands through the loop.

The holder consists of a disk having notches which catch the cord and carry it between the disk and a spring-pressed lever which fits against the face of the disk, thus clamping the cord.

After the knot is tied the cord is cut between the knotter and the holder, leaving the new end of cord thus formed in the holder, the rotation of whose disk has caught the portion between the needle and the knot. A small piece of cord two or three inches long is

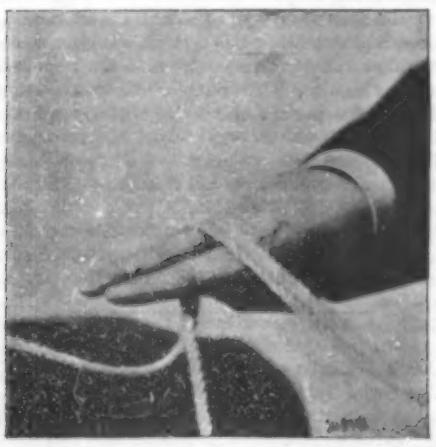


Fig. 3.

Fig. 4.

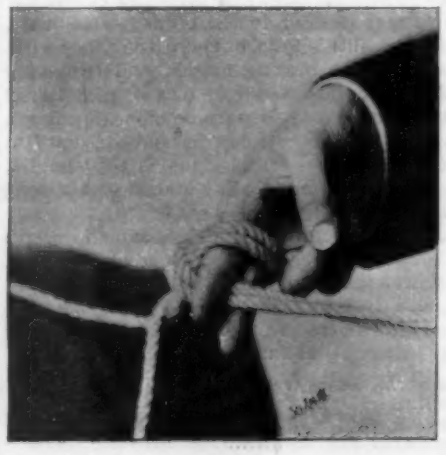


Fig. 5.

Fig. 6.

Fig. 7.

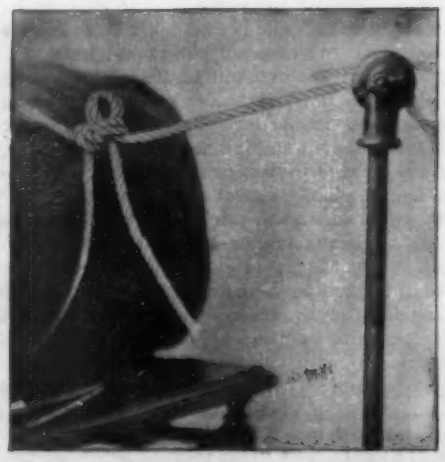


Fig 8.

left in the holder after each knot and drops out as the holder rotates. There are several types of knotters. The one described is the form in most general use.

While a large number of parts are used to operate the essential parts described, it will be seen that the principle of the self-binding harvester, like that of most machines, is comparatively simple.

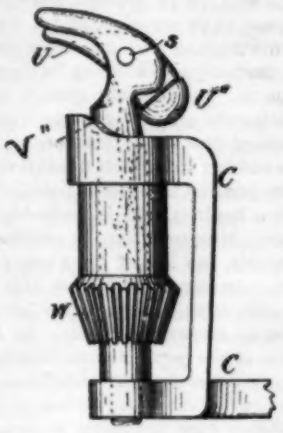


Fig. 9.

A New German Harbor.

A harbor affording increased conveniences for deep sea fisheries has just been completed at Geestemunde, near Bremerhaven. The Prussian State spent about one and one-half millions of dollars on this work. The harbor is 3,940 feet long, 263 feet wide, and 14·5 feet deep at low water. Coal yards and storage houses are provided, and the present arrangements permit of the simultaneous unloading from fifteen ships. A special electric light plant and special water works have been constructed for this harbor. The government expects that these improvements will greatly assist German fishermen, says Uhland's Wochenschrift, in their struggle with foreign competitors.

THE PULPIT OF THE CATHEDRAL OF TREVES.

Of all the countless thousands of tourists who rush up and down the Rhine on the steamers, probably not one per cent ever visit the old city of Trèves, or Trier, as it is called in Germany, though it is one of the most interesting places in the empire. Trèves is situated on the right bank of the Moselle, and can be reached from Coblence by rail or by the river Moselle. A tribe of Belgic Gauls who occupied the territory were conquered by Cæsar, in B. C. 56. In the reign of Diocletian, Trèves became the capital of Belgica Prima, and during the fourth century it was frequently the residence of the Roman emperors. After the introduction of Christianity, the old Roman city became the residence of bishops, archbishops, and electors, until Clemens Wenceslaus, the last elector, transferred his residence to Coblence, in 1786, and in 1815 it was ceded to Prussia.

The city is picturesquely situated in a rich plain surrounded by vineclad hills and wooded heights. Several of the Roman structures still remain in very fair preservation. The principal monuments are the Porta Nigra (a fortified city gate), the brick basilica, the Roman palace, the amphitheater, Roman baths, and the Igel monument, one of the most interesting Roman relics north of the Alps. Even the cathedral itself derives from the Romans. It is one of the oldest churches in Germany, the nucleus consisting of a quadrangular basilica erected by the Emperor Valentinian I (364–375) for commercial purposes and the administration of justice. The church, which was made out of the basilica was partially destroyed by the Franks, but was restored in the original style some time about 550. It was again devastated by the Normans and was restored and increased in size about 1025. The vaulting of the nave and aisles dates from the thirteenth century. The interior contains several monuments worthy of note, and in the high altar is the "Holy Coat" without seam, which is exhibited at rare intervals. This is one of the most famous, if not the most famous of relics.

One of the best bits of detail in the building is the pulpit shown in our engraving, dating from 1572. It was the work of Hans Ruprecht Hoffman. The pulpit is approached by an imposing staircase whose entrance is masked by a doorway. This doorway is heavily overlaid with ornament, though, fortunately, of a good period. The armorial bearings are effectively introduced. The pulpit proper rests on an octagonal column, the facets of the column having small engaged statues. The reliefs on the pulpit are quite high and are well up to the best German work of the period, though they are hardly as pure as the Italian work of the period which had preceded it. A carved canopy completes what is perhaps one of the finest pulpits north of the Alps. For our engraving we are indebted to the Blätter für Architektur und Kunsthandwerk.

PULPIT OF THE CATHEDRAL OF TREVES.

Our Mails in the Early Days.

"In Washington's first term an effort was made to speed the mails—to move them at the rate of one hundred miles in twenty-four hours, or about four and a half miles an hour. This would have been a notable advance, for the carriers were then taking nearly thirty hours between Philadelphia and New York. The roads were bad and there were many slow ferries.

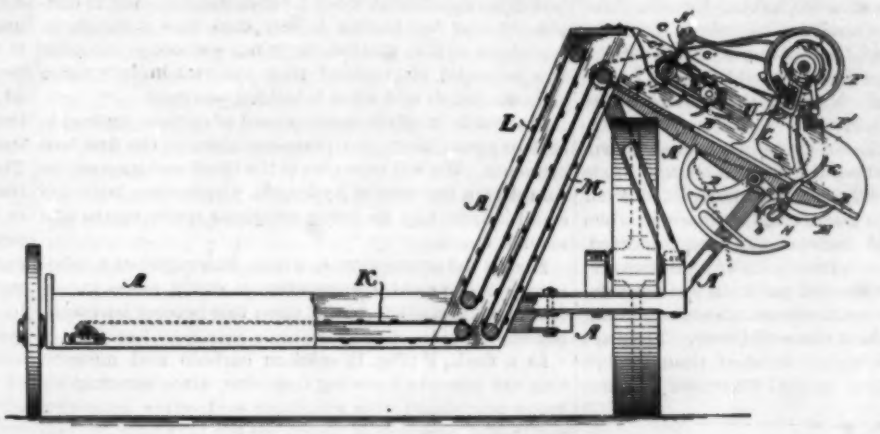


Fig. 1.

. . . In 1776 there were only twenty-eight post offices in the Colonies; in 1795 there were four hundred and fifty-three, and in 1895 there were 70,064. The rates of postage when the department was organized under the Constitution were high; for thirty miles, six cents for one letter sheet; for sixty miles, eight cents; for one hundred miles, ten cents, and so increasing with the increased distance to the maximum, twenty-five cents for distances over four hundred and fifty miles. Stamps were not in use in those days, nor was the sender of a letter required to pay the postage in advance. The postage, six cents or twenty-five cents, as the case might be, was written by the postmaster on the letter, and if the sender paid the postage the word 'paid' was added; if he did not, the postage was collected of the person to whom the letter was addressed. These rates soon yielded a surplus over the cost of the service, spite of the franking privilege which the law gave to congressmen and the heads of departments. . . . The demand of the newspapers and periodicals of every class for cheap postage, seconded by their subscribers, has led to a reduction of rates greatly below the actual cost to the government. In his report for 1892 the Postmaster-General, after stating that the present letter rates pay twice the cost of the letter mail, says that the book and newspaper mail is carried at a loss of six cents a pound. In recent years the Post Office Department has been characterized by a very progressive spirit, and it is now rendering, not a perfect service, but a high class service. No other department has more nearly kept pace with the marvelous development of our country."—Ex-President Harrison, "This Country of Ours," in Ladies' Home Journal.

Arrest of Assimilation.

Mr. A. J. Ewart has carried out a series of experiments on the power of arresting assimilation in green plants exercised by certain agencies: Dry and moist heat, cold, desiccation, partial asphyxiation, etherization; treatment with acids, alkalies and antipyrine; accumulation of the carbohydrate products of assimilation; immersion in very strong plasmolytic solutions, prolonged insolation, etc. He finds, says the Journal Linnean Society, that if the cell remains living the induced inability to assimilate is only temporary; the cell continuing to respire during the whole time of arrest.

In the great majority of cases no visible change in the chlorophyl is associated with an arrest of assimilation. Cells in which the green color of the chlorophyl is quite masked by the presence of a brown or reddish brown pigment may exhibit a distinct power of assimilation. In certain cases isolated chlorophyl bodies may continue to assimilate for a short time after removal from the cell to which they belong.

Science Notes.

Sir Benjamin Ward Richardson, M.D., F.R.S., died on November 21, aged sixty-eight years. An extended biographical notice, with portrait, will be found in the SUPPLEMENT, 1092. He had made important investigations on the effects of anæsthetics, having discovered the use of ether spray for the abolition of pain in local surgical operations. He was the author of many articles and books treating especially of the subjects of public health and social reform. Many of these articles were printed in the SUPPLEMENT.

Some idea of the enormous trade in musical instruments may be gained when it is stated that a single firm, Messrs. Lyon & Healy, has just completed their one hundred thousandth guitar. The time was when nearly all of our musical instruments were imported, but now, thanks to improved methods of manufacture, artists do not have to go abroad for their instruments, and, in fact, American musical instruments are beginning to be known as the standard the world over. They are more durable and more highly finished than foreign goods—the result largely of special American machinery.

The Influence of Mountain Air.

It is a matter of no small interest to that large number of poitrinaires who annually betake themselves to the mountains for the winter months to ascertain how the benefit is brought about which they undoubtedly receive. By many the mechanism of the Alpine cure has been a mere matter of physics, says the London Hospital. Recognizing that phthisis is chiefly prone to occur among those who from their mode of life do not thoroughly expand their lungs, and that in the rarer atmosphere of high altitudes a much more complete expansion of the lungs is necessary, to obtain the same quantity of oxygen, than would be required in the denser air of the plains, the benefit of residence in the mountains has been attributed to a constant unconscious effort to expand the lung more fully, and to the consequent greater interchange of air in its recesses. Certainly the marked enlargement of the capacity of the chest which is often found after a few months' residence in the high Alps, and the tendency to the development of compensatory emphysema around the diseased and contracting portions of the lungs, tend to show that this theory is correct so far as it goes. But all who go into the Alps feel that there is something more than this in mountain air, and it has recently been shown that not only do the chest muscles adapt themselves to the new conditions, but that the blood itself becomes altered in response to the lessened amount of the more rarefied oxygen which each blood corpuscle can carry.

The effect of this process of adaptation is that the red corpuscles multiply considerably while, according to some, the hemoglobin is also increased. In any case, the oxygen carrying capacity of the blood is increased. This accords fully with the well known effect of mountain air in the treatment of anemia, and also with the feeling of well being felt by visitors to high altitudes. It does not do, however, to dissect a climate too much, or to attribute to one or two factors what really is due to the concurrence of many influences, and it seems probable that mountain air depends for its efficacy on many conditions besides its lessened density, such, for example, as its purity, its dryness, and its comparatively low temperature, combined with the intense solar radiation common at high altitudes. That these are the really important conditions, and that lowered barometric pressure is not everything, is shown by the fact that to get the full benefit of the mountains people must get out of doors, whereas the lessened density of the air should affect those indoors just as much as those outside. Nevertheless we are quite prepared to believe that the compensatory blood changes produced by residence in the mountains are important elements in the "mountain cure."

New Docks at Gibraltar.

Under date of August 31, 1896, Consul Sprague, in his annual report, refers as follows to the building of new naval docks in Gibraltar:

The continued increase of the British navy in battleships and cruisers of formidable dimensions is urging upon the government the necessity of establishing, without further delay, increased docking facilities for their new specimens of naval warfare, not only at home, but in the colonies. Gibraltar has been one of the coaling stations which has already received the earnest attention of the Admiralty, owing to its deficiency in dock and other accommodations for the refitting of war ships, besides securing protection from outward attack for the large stock of coal that has to be kept on hand. The construction of these formidable works has already commenced, with the employment of about 4,000 workmen of all classes, who are daily kept hard at work, under the special charge of superintendents sent out from England by the Admiralty authorities, who control everything connected with this important undertaking, which is likely to consume at least five years for its completion and an outlay of several millions of pounds sterling.

ABSOLUTELY PURE ALCOHOL FROM ACETYLENE GAS.

Acetylene, already so much spoken and written of as an illuminant, threatens to introduce itself in the confection of liquors. This use of it may, at first, appear but little appetizing, when its disagreeable odor is considered, but we hasten to say that care is taken to transform it into alcohol, for it is a gas which contains the principal elements of that precious liquid; there remains but to add what is lacking—oxygen.

Alcohol is, in effect, a compound of carbon, hydrogen and oxygen; acetylene possesses already the first two elements. We will now give it the third and increase to completion the dose of hydrogen, which was a trifle too small in quantity to bring acetylene quite up to the alcohol stage.

Here is the arrangement, which, although but a laboratory experimental apparatus, is easily made industrial, should a plant based upon this process be established.

In a flask, F (Fig. 1), calcium carbide and metallic zinc are placed: knowing that zinc, when attacked by water acidulated with sulphuric acid, gives hydrogen gas in the presence of water, we see here that the calcium carbide freely evolves acetylene gas. In the flask, E, put, then, water and a little sulphuric acid and connect this flask with the first by a flexible tube, so that, when E is elevated or lowered, we may introduce or withdraw, at will, liquid in the flask, F, according to the need of the production.

The acetylene and the hydrogen, developing at the same time, do not fail to seize the opportunity for combining. In the nascent state bodies always have a greater affinity for each other than at a later stage.

It is of this marriage, then, that the ethylene is born, which, being now disengaged, goes over into the glass worm, P, where it comes in contact with concentrated sulphuric acid heated to 80° (Centigrade), which is slowly poured into a funnel, A; it is here that it gets its oxygen. It now forms a new body, which is ethylsulphuric acid. This is collected in the flask, D, and is brought to ebullition. Here it is decomposed into sulphuric acid, which remains, and may be used again, and into alcohol, which evaporates but is collected and condensed by means of tube, R, connecting with worm, B, surrounded by a current of cold water circulating from H to C.

APPARATUS FOR MAKING ALCOHOL BY MEANS OF ACETYLENE GAS.

F. Flask containing calcium carbide and scrap zinc. E. Water acidulated with sulphuric acid. A P. Glass worm in which hot sulphuric acid circulates. D. Flask to collect and distill ethylsulphuric acid. R B. Worm for condensing vapors of alcohol. M. Flask for the pure alcohol, condensed. H C. Liebig condenser.

In M is collected an alcohol absolutely pure,* which industrially produced would not cost more than 20 centimes (4 cents) per liter. It contains none of those essences which are always present in the vegetable alcohol, and which render them dangerous for consumption.

It is not a little curious that alcohol furnished in large quantity by the vegetable kingdom is now going to be given us by the mineral world, and at a ridiculously low price. It would seem that in combating alcoholism we are going against the laws of nature. After all, we had best conclude that if Dame Nature thus places alcohol in profusion within our reach, it is not to take the place of water as a beverage.—From Le Monde Moderne. Translated by J. Colton Lynes, Ph.D., ex-president Georgia Agricultural College, etc.

* The chemistry of the process is not given in the original; it is, however, very simple. In flask F we have

$Zn + H_2SO_4 = ZnSO_4 + H_2$.

Zinc + sulphuric acid = zinc sulphate + hydrogen.

$CaC_2 + 2H_2O = Ca(OH)_2 + C_2H_2$.

Calcium carbide + water = slaked lime + acetylene

At the instant of the above reaction this is formed

$C_2H_2 + H_2 = C_2H_4$.

Acetylene + hydrogen = ethylene.

And in tube and worm, A P, we have

$C_2H_4 + H_2SO_4$ (hot) $= C_2H_5\}HSO_4$.

Ethylene + sulphuric acid = ethylsulphuric acid.

Which, being boiled in D, decomposes thus:

$C_2H_5\}HSO_4 + H_2O + heat = C_2H_5.OH + H_2SO_4$.

Ethylsulphuric acid + water + heat = alcohol + sulphuric acid.

Changes in the Pupil in the Insane.

At the recent meeting of German alienists at Heidelberg, Dr. Soemerling contributed an important paper on this subject. He attaches little importance to a difference in the size of the pupils of the eye, as they are not uncommonly unequal in those who are in perfect health. The loss of reaction to light, on the other hand, he regards as of the utmost importance and significance, and of all conditions of the pupil in the insane it is the most frequent and the most important. In 3,010 cases of progressive paralysis it was found to be present in 88 per cent, and it forms an early symptom in this disease, and may exist as an isolated one for so long as ten years without having other symptoms added to it. It is nearly always bilateral, although the two pupils are not always equally affected and the shape of the pupil may be round, oval, or irregular. The sudden and quick dilatation of the pupils is sometimes present in general paralysis, but this occurs also in the healthy, and is probably without much significance. Hippus is rare in paralysis. Except in general paralysis, the loss of light reflex in the pupil is uncommon. Among 9,100 insane this symptom was present in 1,639 cases, and of these 1,524, or 92 per cent, were cases of general paralysis. In syphilis, also, this condition of the pupil is sometimes found without evidence of any other morbid condition. Its occurrence after injuries to the head alone is very doubtful, and it probably does not occur in simple and uncomplicated hysteria. In short, he regards the loss of light reflex as a symptom of weighty import and grave significance. If it is not a precursor of tabes dorsalis or general paralysis, it at least indicates a profound disturbance of the nervous system, and it may be present long before any other morbid phenomenon manifests itself. A few other unimportant variations in the pupil in connection with epileptic and other attacks are referred to, and, in conclusion, the question is raised as to the position of the central mechanism on which the pupillary reaction to light depends. No definite group of cells can as yet be indicated as the center for this reflex.—Lancet.

Artificial and Natural Petroleum.

M. Francis Laur, in a communication to the Echo des Mines, says the American Gas Light Journal, calls attention to the unexpected discovery of the artificial production of petroleum, which, he says, starts a new question of great interest to scientists, as to whether petroleum is an ancient deposit in the earth's surface or is being reproduced to-day in the lower series of measures. Those who consider that the production of petroleum is contemporaneous are, says M. Laur, unable to account for the method of its formation, and have to be content with the mere hypothesis of certain obscure reactions which took place in the bowels of the earth. Now, however, it is only needful to invoke the presence of the metallic carbides which exist in the central nucleus and which can be reached by the water which is sucked in through the earth's crust, so that it is rational to suppose that firedamp, acetylene, petroleum, tar, and inflammable gases of all kinds may be produced and infinitely modified by the difference of pressure and temperature. Arguing from this point, M. Laur suggests that Lake Baku must, if this is the case, be the outward and visible sign of a natural production of hydrocarbides, while the Caspian Sea, whose issue has not so far been determined, but whose boundary does not grow less, may be regarded as a natural means of feeding the important internal laboratory where the petroleum is produced.

Skilled Workmen Choose the Scientific American.

One of the largest and most influential manufacturing concerns in the Western States, the W. F. & John Barnes Co., of Rockford, Ill., has been in the habit for several years of making a Christmas present of a year's subscription for the SCIENTIFIC AMERICAN to those of its workmen who wished to take the paper. This year twenty-one copies were thus subscribed for. In order to ascertain the comparative popularity of our journal among its employes, we wrote the firm as follows: "We would like to know whether the SCIENTIFIC AMERICAN is the only publication to which you subscribe for your most progressive workmen, and whether you give the men their choice of publications. We make this inquiry as we are a little curious to know as to the popularity of the SCIENTIFIC AMERICAN among your workmen."

To this we received the following reply: "In answer to your inquiry we beg to say that the SCIENTIFIC AMERICAN is the only publication for which we send subscriptions for our men. We would, of course, be perfectly willing to send subscriptions for other papers or magazines if they desired, but they do not seem to make any inquiry for anything but the SCIENTIFIC AMERICAN."

Emil Du Bois-Reymond.

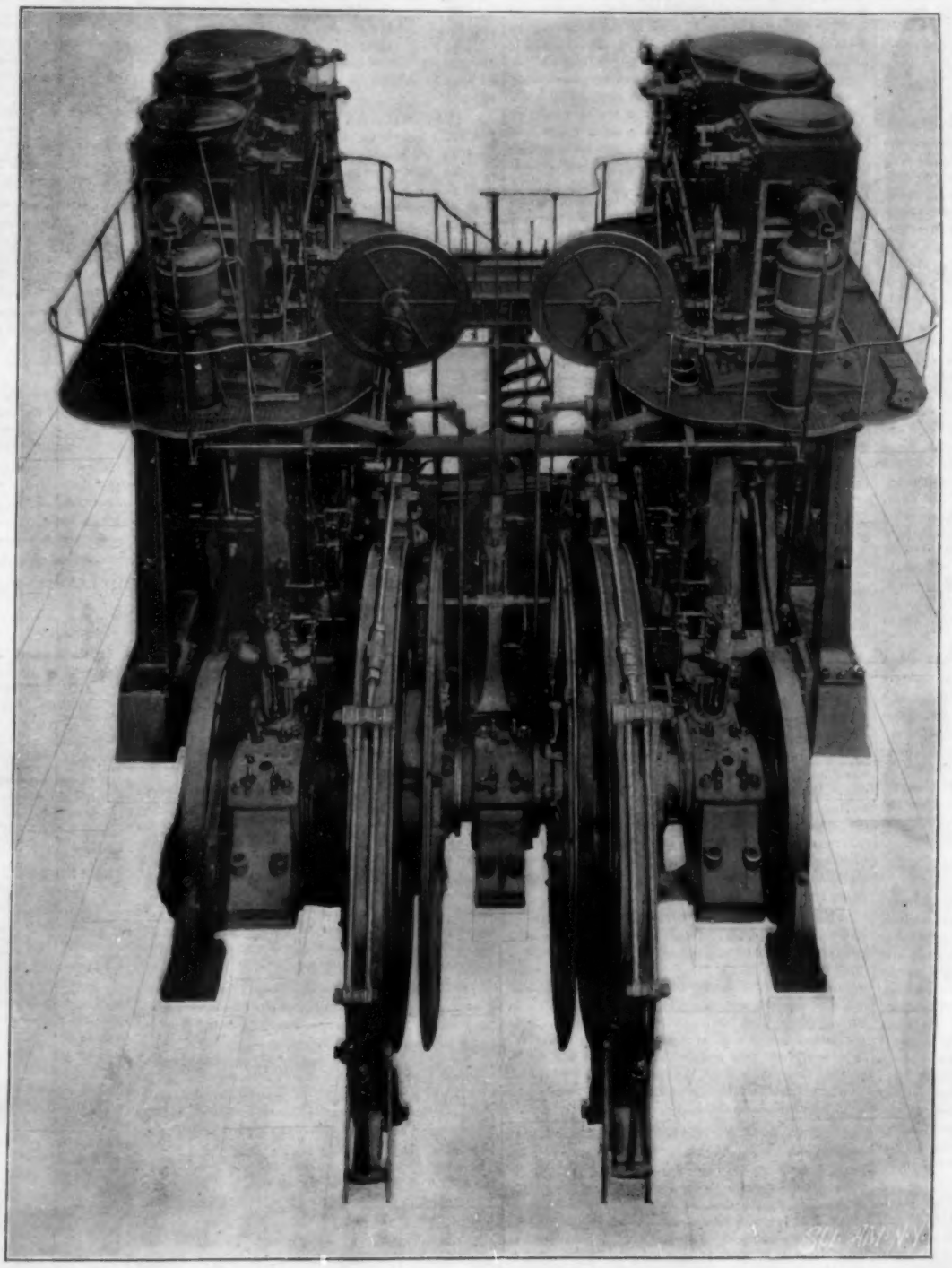
Prof. Emil Du Bois-Reymond, the distinguished physiologist, died in Berlin on Saturday, December 26. He was born in Berlin in 1818. He began studying theology, but abandoned this for natural science. After a sojourn at Bonn he returned to Berlin, and studied anatomy and physiology under Jean Muller, and on his advice undertook his researches in animal electricity, on which subject he published several works. In 1868 he replaced his master as professor of physiology at the University of Berlin, and was named, in 1867, perpetual secretary of the Berlin Academy of Sciences.

HOISTING ENGINES FOR THE ANACONDA MINE.

The accompanying illustration depicts a front view of one of a pair of hoisting engines recently built by the Union Iron Works, of San Francisco, and now being erected on the "Never Sweat" shaft of the Anaconda Mine, of Butte, Montana. Its mate is also being erected at the same time on the Montain Con. shaft belonging to the same company.

The work of these engines will consist in raising four deck cages, each loaded with one ton of ore, at the rate of about 3,000 feet per minute. The total load, including rope, cages, cars and ore, is about 26,000 pounds.

These mammoth pieces of machinery are named the "Modoc" and "Aztec," and are the largest of their kind ever built on the Pacific coast. Each consists of one left hand and one right hand compound beam engine, connected with the reel shaft by disk cranks, the crank pins being set at right angles. The cylinders are vertical and inverted. There is one high pressure 26 inches in diameter and one low pressure 46 inches in diameter for each engine, making four cylinders for each machine. The pistons are connected with the opposite end of the beams by piston rods, crosshead and reach rods or links. At the top, or king post, of each beam one of the main connecting rods takes hold, while the opposite end of the rod is attached to the crank pin, which at all times will give a positive stroke of 72 inches to the pistons.



COMPOUND HOISTING ENGINES FOR THE ANACONDA MINE—HIGH PRESSURE CYLINDERS 26 INCHES DIAMETER; LOW PRESSURE CYLINDERS 46 INCHES DIAMETER; STROKE 72 INCHES.

The high pressure cylinder is located in front of the low pressure cylinder, with a reheater between them. Both are steam jacketed. The condenser water will be automatically carried off from the jackets by steam traps discharging into feed tanks or condensers. The cutoff valve gear mechanism on the low pressure cylinders is adjustable by a hand lever or governor, as desired, while the cutoff valve gear mechanism of the high pressure cylinder is controlled by a governor and by a hand lever on a working platform. The cylinders of each engine are supported by a cast iron frame, consisting of four vertical and four diagonal columns resting on a heavy bed plate and securely bolted to it. They are handsomely covered with teak wood lagging, with highly finished metal covers at the top end.

The main valves of each engine are of the Corliss type, and are worked by a wrist plate, which derives its motion from an eccentric on the reel shaft and a crank on the beam pin. The motion is a modification of the Walseheart valve gear. The reversing gear is operated by a separate engine and a hydraulic controlling cylinder. The beam center bearings are cast in and form part of the main sole plates. The same is also true of the main bearings for the crank shaft. All are substantially fitted, and provision is made for adjustment in case of the wearing away of the moving parts. On each crank shaft there will be two reels, each of the capacity of about a mile of flat wire rope. They will be operated independently, or in balance, as may be desired. Each reel will be provided with a patent friction band clutch applied by an entirely separate engine, and hydraulic controlling cylinders. The reel brakes are of the Post pattern, with beams of heavy cast iron securely braced with steel rods, bound together at the top and bottom, each operated by a special engine and also controlled by hydraulic cylinders. The auxiliary engines for working the reel brakes, reel clutches, reversing gear and disk brakes are operated by hand levers, all conveniently grouped on the operator's platform, which is located between the engines and forms part of the main engine gallery. Each reel is provided with an ingenious arrangement for indicating the position of the cages in the shafts and the speed at which they are moving. To the end of the rope on each reel will be secured a four deck cage, which, when loaded and in full motion, will travel at a velocity of forty feet a second, or nearly half a mile a minute. A governor, fitted to each pair of engines, entirely controls them, giving a uniform speed to the cages, and regulating the valve gear tripping mechanism, so as to cut off at the most desirable portion of the stroke. By this means an economical distribution of the steam is secured in the cylinders and saving is made in the fuel consumed.

One main, central winding stairway leads to the upper gallery, or operator's platform, and there are numerous smaller platforms winding their way around those parts of the engine requiring constant attention or adjustment. The platforms are provided with brass-capped iron stanchions and with brass hand railings, neatly designed and highly polished. Only brass piping is used around the engines and brass drip pans are placed to catch the waste oil from the journals.

To work one pair of these engines in all of their requirements, the operator has one foot and seven hand levers to handle, while in front of him are located the two indicators, which will require his constant attention while the machinery is in motion.

Each pair of hoisting engines has seven separate subordinate engines, and each pair weighs about 400 tons.

PROF. J. H. HART, of the Royal Botanical Gardens, reports the flowering of the bamboo this year at Trinidad, says the Popular Science News. He ascribes this rare occurrence to the thinning out of the clump last November, when a number of the stems were cut to provide fencing for the race course. In his twenty years of residence in the West Indies Prof. Hart has observed the flowering of the bamboo on two previous occasions only—in Jamaica in 1885 and in Trinidad in 1887.

Railroad Progress.

Probably few people at the present time can realize what a quaint and curious line the Liverpool and Manchester Railway was in its early days, or how totally different were all its appointments from those to which we are now accustomed, says the Railway World. Yet travelers were vastly pleased with it, and thought that to pay five or six shillings to go thirty miles in an hour and a half was the perfection of cheapness and speed. They went into ecstasies about the delight of jingling along over a jarring stone block road, in compartments about as commodious as our London four wheeled cabs or in semi-open chars-a-banc, where they became blinded with sparks and ran considerable risk of being set on fire. Every time the train stopped the passengers were bumped against each other, screw couplings being unknown till 1835; but they seem to have borne it all complacently. The first class vehicles were painted yellow, and bore such names as Queen Adelaide, Marquis of Stafford, Treasurer, and Despatch. Being usually eighteen feet long, upon a base of only six feet, they pitched up and down considerably as they ran. To the second class coaches there were light roofs or awnings, but often no sides and no doors; the color of these airy conveyances was blue or pink. About two and a half tons was the average weight of all the coaches, some more, some less, but all were constructed in the lightest and weakest manner, by builders who had by no means grasped the difference in working conditions between road and rail traction. The guard sat on the roof of the last coach, or of one fitted with a brake, and was exposed to rain and snow, heat and cold, dust and sparks, in a barbarous manner. This mode of treating a man so important to the safety of the train was usual on most lines in this country till nearly 1850, and was but one of the many ways in which the early railway men copied the stage coach system without considering how essentially different it was. The first class were "inside" passengers. The second were "outside," who must expect a taste of bad weather. The third were inconsiderable "stage wagon" people, who were contemptuously hitched on anyhow. Even as late as the seventies might be seen an inscription over the gateway of an important London terminus: "Entrance for horses, dogs, and third-class passengers."

Paper Clothing.

The Japanese have for a long time been making underclothing of their finely crisped or grained paper after the sheets have been pasted together at the edges so as to form large pieces. After the paper has been cut to a pattern, the different parts are sewed together and hemmed, and the places where the buttonholes are to be formed are strengthened with calico or linen. The stuff is very strong and at the same time very flexible. After a garment has been worn a few hours, it will interfere with the transpiration of the body no more than do garments made of fabric.

According to the Moniteur de la Papeterie Francaise, this paper weighs about ninety grains to the square foot. It has been submitted to tests that gave a breakage length of fifteen feet in the direction of the paper lines and seven feet in that of the wire marks, with an elongation of 9·7 per cent in the first case and of 7·9 in the second. The stuff is not sized, nor is it impermeable. Before exposing himself to the rain, the Japanese takes shelter under his large waterproof umbrella. However, even after it has become wet, the paper is difficult to tear. When an endeavor is made to tear it by hand, it presents almost as much resistance as the thin skin used for making gloves.

RECENTLY PATENTED INVENTIONS.

Engineering.

PROPELLING VESSELS.—Conrad Odinet, New York City. According to this improvement the bottom of the hull is made with a central lengthwise housing, divided from bow to stern by the keel so as to form two lengthwise channels, in which are gates operated from the interior of the hull, shafts carrying propellers being also journaled in and extending the length of the channels, and these shafts being geared with vertical shafts operated by a motor within the vessel. With this construction the vessel may be turned as on a pivot, the propellers being capable of acting substantially as a rudder, and the plan is designed to give increased speed with a moderate expenditure of power. To adopt this improvement no changes are necessary in the present method of hull construction, except to provide for the longitudinal housing on the bottom of the hull.

EXCAVATOR.—Francis M. Phillips and Eugene Siebinger, Portland, Oregon. This is a machine in which provision is made for breaking the earth by a plow, when it is conducted by scrapers to pocket wheels and delivered to a basin, being taken from the basin by an elevator and carried to a conveyer, from whence it is delivered at one side of the machine into any suitable receptacle. The machine may also be used as a scraper, ditcher, or wagon loader, and with slight modifications may be used for cleaning streets or roads.

Railway Appliances.

CAR BRAKE.—Benjamin F. Jackson, Sutton, West Va. This brake comprises transverse brake bars carrying shoes, the bars having springs holding them normally in engagement with the wheels, and connected rods being adapted, when moved in opposite directions, to throw off the brakes and place the springs under tension. The rods are operated by a lever mechanism to hold the brake shoes out of engagement when the car is in motion. The entire apparatus is strong, simple and inexpensive, and adapted to quickly stop a car without putting too much strain on the running gear or on the brake itself.

ELECTRIC SIGNAL DEVICE. — George F. and F. K. Singer, Steubenville, Ohio. This invention provides for a battery, and an alarm at each end of the train, the batteries and signals being in circuit wires coupled by two casings in which are novel contact devices, and the couplings being drawn apart should one car be separated from another, thus sounding a signal on the engine and on one or more cars. It is designed for use also on passenger trains as a signal to the engineer and a return signal to the conductor, or vice versa, where the train may be stopped at flag stations, doing away with the need of using the whistle in villages, and may also be employed to give an alarm to the engineer should a car door or brake beam be hanging, or should there be other derangement liable to endanger the train. The equipment is designed to be inexpensive, is useful on freight as well as passenger trains, and is arranged to facilitate train signaling in every way.

RAILROAD SCREW JACK.—Alexander H. Moyes, Ogden, Utah. This invention relates to a formerly patented invention of the same inventor, and provides a jack more especially adapted for jacking up cars, engines, journal boxes, etc. It has an interiorly screw-threaded casing with exterior annular teeth, a post operating in the casing and a sleeve loosely embracing it, but having at its upper portion an internal tooth engaging the annular teeth, while an arm projecting from the sleeve is adapted to engage the wheel rim to hold the wheel down to the rail while jacking up the journal.

Mechanical.

PIPE WRENCH.—Julius Richard and Frederick Colman, Bisbee, Ariz. This is a chain wrench having links adapted to be brought into engagement with a pipe, the links having concaved inner faces and being so formed that they will fit snugly almost entirely around the pipe, their continuous and even bearing preventing the pipe from being crushed while being subjected to the force necessary to turn it. The chain body of the wrench is provided with a lever by means of which the pipe is tightly clamped when the lever is moved in one direction, the pipe being released from clamping engagement when the lever is moved backward. The construction of the wrench is such that it may be conveniently used where pipes are close together or near a wall or partition, and the lever may be readily disconnected from the other portions of the wrench.

RATCHET WRENCH.—Edward T. Warn, Malden, Montana. Within a band carried by the handle of this wrench is a revoluble frame carrying a removable sliding jaw, a cog ring revoluble within the frame meshing with a pinion, there being means for turning the cog ring and moving the frame with the handle. The several parts are readily separable one from the other, and the wrench may be quickly changed to operate either to the right or left. It may be conveniently used in a very small space, as in boilers, stoves, etc.

NUT LOCK.—William H. Fossett, Walsenburg, Col. This is a nut lock of the ratchet type, and is adapted to secure a nut at any desired point on a bolt when suitably adjusted on the threaded body of the bolt. The bolt is longitudinally grooved and the nut has a recess in which is a pivoted dog with a toe arranged to engage the groove in the bolt, a spring normally holding the dog in engagement therewith, and the spring and dog being moved out of engagement by means of a nail or any simple tool.

Miscellaneous.

HINGE.—Louis Bartelmes, Brooklyn, N. Y. This is a hinge particularly adapted for use in connection with the box section of couches, serving, in addition to controlling the throw of the cover, to hold the cover locked in either open or closed position. It has two toggle links, each composed of two pivotally connected members, the adjacent ends of the links being pivoted to each other, and a coiled spring carried by one link having its terminals respectively connected to the outer portions of the members of the link.

BRAKE SHOE.—Alva A. Lindley, Oskaloosa, Iowa. This is a shoe designed to be held perfectly rigid to the brake head, preventing a tilting of the shoe and uneven wear of its bearing face. It has a tapering extension from the central portion of its forward face adapted to fit a tapering slot formed in the head, in which it is held by a locking pin, and should the shoe work loose from the head, it will drop outside the path of the wheels.

GARMENT.—Otte Van Oostrum, Portland, Oregon. This invention is applicable to vests, trousers, jackets, etc., providing means whereby the usual open portion will be held closed in an efficient manner and present a neater appearance than when fastened in the usual way. An inner flap is secured along one of the edge portions, the latter being made to abut, and the flap extends under the opposing edge, on the under surface of which are fasteners, to which are attached fasteners on the flap. An operating cord is connected with one of the series of fasteners for simultaneously releasing them.

GARMENT FASTENERS.—The above inventor has likewise obtained three different patents on garment fasteners, to be secured to wearing apparel, including gloves, corsets, shoes, suspenders, etc., and arranged to be released simultaneously by means of a cord or chain connected to certain parts of the fasteners. In these fasteners a member has a slotted top plate and is provided with a series of locking pieces adapted for engagement with a stud, one of the locking pieces being reversed to engage and disengage the stud, which has a head projecting beyond the shank and a socket member having a keyhole orifice with a spring acted follower at its larger end, the stud being movable into the narrowed portion of the orifice, and the follower exerting a pressure toward such portion. Another provision is for a button member comprising a plate having an orifice, and a second spring acted plate radially slitted and carrying a stud adapted to be projected through the orifice of the first plate, an arrangement according to which there will be little or no projection of the parts at the inside of the garment, thereby insuring a better set.

BATTER MIXER.—Stephen H. Coombs, Helena, Mont. This is a device provided with beaters which operate rapidly in opposite directions, with both a vertical and lateral throw, thus thoroughly and quickly whipping cream, beating eggs and stirring batter, etc. It comprises a frame having parallel legs, on which guide blocks are adjustably mounted, while the beaters have side members movable through guide eyes on the blocks, the beaters being operated by rotating gearing and being adjustable for a greater or less throw, according to the character of the material operated upon.

SHAVING MUG.—Bernard G. Savage and Albert C. L. Loughran, Victor, Col. This mug has a mirror detachably connected with its bottom and forming the permanent base of the mug, and the cover is adapted to be screwed on and fit closely to the top. In the center of the cover is a threaded opening, which receives the threaded ferrule of the brush handle, the brush portion extending down into the mug. The handle also has a recess for the accommodation of a stick of cosmetic or like material. The mug may be conveniently and safely packed.

BOTTLE STOPPER.—Henry Friedman, New York City, and Herman M. Koelbel, Brooklyn, N. Y. This stopper has a casing with the lower portion internally threaded and slotted semispherical upper end, while a ball valve with a central bore has a discharge pipe extending out through the slot of the casing and serving as a handle for manipulating the valve. A stopper proper is provided with a central pipe and screws into the casing, with its upper end in contact with the valve and forming a seat therefor. The stopper is very serviceable on bottles containing liquids liable to evaporate.

ANIMAL TRAP.—Ferdinand E. Krauth, Hebron, North Dakota. This is a self setting trap more especially designed for trapping mice, rats, gophers and other small animals. It comprises a box with two compartments, and a bottom opening between them, a guard at the passage on one side and on the other side an L-shaped tilting trap having a weight to return it to its normal position, while a swinging gate pivoted near the inner end of the trap has at its front side a leg supporting the trap and at the opposite side a feed box. The gate and bait receptacle are preferably made of a single piece of sheet metal.

BICYCLE ATTACHMENT. — John G. McNaughton, Salisbury, N. C. To prevent mud from being thrown by the rear wheel upon the rider and to protect the skirts of a lady and prevent them from being blown about by the wind or being caught in the chain or wheel, this inventor has devised a mud guard having hinged wings on each side to act as guards and a shield for the legs, the guard being preferably constructed in the form of an eagle bending over the rear wheel, his head pointing rearward and his wings extending outwardly on each side. The guard is rigidly mounted on the lower side bars and the braces which extend from the bearing of the rear wheel to the saddle post.

POWER TRANSMITTING DEVICE FOR BICYCLES, ETC.—Charles F. Dinkle, Carlisle, Pa. This device, which is also adapted for use on light machinery, consists principally of a ratchet wheel secured to the shaft or axle, a transmitting wheel loosely surrounding the ratchet wheel, while a series of toothed wedges held in wedge-shaped recesses in the transmitting wheel are adapted to engage the ratchet wheel. When the improvement is applied to a bicycle it permits the rider to coast with the feet on the pedals, the latter remaining stationary while the drive wheel continues to run by the momentum of the wheel. When the rider again commences to work the pedals their motion is transmitted to the drive wheel as usual.

CARBONATING DEVICE.—John W. Seavolt, Lock 33, Md. This is a device for attachment to beer kegs, barrels, etc., for automatically discharging carbonic acid gas into the receptacles as the liquid contents are drawn off, thus keeping the remaining liquid under pressure and in good condition. A receptacle containing carbonic acid gas under pressure has an inner cylinder in which slides a spring-pressed piston, arranged to automatically establish and cut off communication between the receptacle and the keg or barrel, an operation which is repeated whenever part of the contents of the keg or barrel is withdrawn. The casing of the carbonating device is adapted to be secured to one of the heads of the keg or barrel, and project into its interior, taking up but little space.

SIGHT FOR FIREARMS. — Charles G. Thunen, Oroville, Cal. This invention provides sights especially designed for close and accurate sighting, while not obstructing the view of the object aimed at. The sight comprises two transparent disks, the front one having a small opaque spot in the line of sight and the rear one having a hole concentric therewith, with its edge countersunk and coated with some opaque substance. The mounting may be of any of the usual forms, the sights being applicable to any form of mounting.

WEIGHING AND REGISTERING MACHINE.—George A. Hanna and Frank E. Fairman, Whittemore, Iowa. This is a machine more especially designed for weighing and registering liquids, as skimmed milk at a creamery, and is arranged to automatically deliver to the milkman the quantity of skimmed milk due him, from the milk originally brought to the creamery. The scale beam carries a skim milk receptacle having lever-controlled inlet and outlet valves, a tripping device actuated from the scale beam being connected with the lever. Special means are provided for resetting the tripping device and actuating the lever, setting it in position to close the outlet valve and open the inlet valve.

CONFECTIONERY MACHINE. — Simeon J. Hicks, Chicago, Ill. This invention is for an improvement on a formerly patented invention of the same inventor, and provides a machine to readily cut into small pieces a drawn and flattened piece of candy and remove the cut pieces from the knife. The machine has horizontally arranged fixed knives above which are movable knives, a comb extending across and having its teeth projecting between the fixed knives, there being means for reciprocating the comb over the fixed knives on the return movement of the movable knives.

MECHANISM FOR WIRING BASKETS.—George B. Thayer and Erskine D. Wheeler, Benton Harbor, Mich. For wiring or stapling fruit and other baskets or boxes this invention provides a staple driving machine, the frame of which forms a bearing for a pair of reciprocal rods carrying a rigid crosshead on which is a staple-clinching anvil, a rotatable crosshead being connected with the rigid crosshead, while a basket form has sliding bearing on the rotary crosshead. The basket and its form are held in position while the staples are inserted and clinched by a lever which is rocked by a treadle, leaving the hands of the operator free to attend to other parts of the work.

EASEL ATTACHMENT.—George A. Robbins, Slate Hill, N. Y. This is a convenient device for holding sketches or drawings from which a finished picture is to be made, means being also provided for holding drawing or painting materials. A bar is adjustably mounted on an arm having a clamp for engaging an easel, a telescopic bar extending vertically from and adjustable with relation to the first bar, while a telescopic bar is mounted horizontally on the vertical bar, there being a picture-holding clamp on each member of the horizontal bar.

DRAWER FOR DOCUMENTS, ETC.—Thomas G. Knight, Rockville Center, N. Y. In this drawer documents and index cards may be held to be accessible without completely removing them, or disturbing the arrangement and parts of the box. Its sides are cut out at the top, and at one side is a removable pivot rod adjacent to a cut out portion, while transverse receptacles adapted to contain the documents have each a perforated upper corner opposite its open end, enabling the receptacles to be fulcrumed and swing upward on the rod. Index cards are similarly fulcrumed on the rod, and may be readily swung up for examination without being removed from the drawer.

INHALER MASK.—Alfred Orr and Andrew W. Chapman, Charleston, Mo. A hood covers the head in an airtight manner, according to this improvement, an outer inhaling tube having an apertured mouthpiece extending within the tube, the inhaling tube having openings for the admission of air to the interior of the tube, while a second tube of thin and collapsible material, as a conductor for expired air, is secured within the first tube and connected with the mouthpiece. The apparatus is very light and can be folded in small bulk, is preferably made of rubber, and, while in use, does not interfere with the hands of the operator. It affords perfect protection to the wearer when exposed to infected air or pernicious gases.

JAR CLOSURE. — Frank H. Palmer, Brooklyn, N. Y. This patent is for an improvement on a formerly patented invention of the same inventor. The jar has an annular shoulder, and in the convex outer surface of the cover are grooves at right angles to each other in which lie spring bails whose inwardly bent ends engage the shoulder of the jar. One bail has at its middle a downward bend to receive the other bail, the body portions of the bails lying in the grooves, with their upper surfaces flush with the upper surface of the cover, and a seal is secured to the cover over the bails.

BOTTLE STOPPER.—Alfred L. Bernardin, Evansville, Ind. This stopper is formed of a soft, flat rubber body or disk, having a central vertical opening lined with a rigid tube adapted for the reception of an extracting tool, the disk being adapted for compression within a bottle neck and direct engagement with a shoulder therein, and an independent protector being applied to and secured on the lower side of the disk to cover the open end of the tube. The stopper is driven into the bottle neck by mechanical pressure and then performs its functions when forced upward against an annular seat by the pressure of the gas confined in the bottle. The seal may be bodily extracted with great ease, and corrosion of metal and leakage are entirely prevented.

BRUSH.—Aloys Schuck, Brooklyn, N. Y. To form a brush in which the stock will be firmly held, this inventor employs a cone or funnel, the apex of which is stamped or spun down to produce a ferrule in which the handle is fixed, the stock being bundled at one end and permeated with cement and then projected into the smaller portion of the funnel directly below the handle. When the parts are thus arranged the funnel is stamped down at its larger or lowermost portion to a flat form, spreading the bristles.

MOLASSES PITCHER.—Silas P. Brown, Canova, South Dakota. This is a pitcher for table use, freely delivering its contents, but preventing any exterior escape of slight drippings, which are returned to the body of the pitcher. The pitcher has a hinged lid adapted to cut off the flow from the lip, beneath which is a trough communicating with the interior, while an exterior cover receives the other part of the pitcher and is hinged to the same pivot as the lid, the cover having a thumb piece projecting between limbs of the lid.

MEANS FOR OPERATING FANS, ETC.—Alfredo, Antonio D. and Marcos Flores, San Antonio, Texas. This invention is for a light and simple apparatus in which a suitable frame carries a ratchet and pawl mechanism to work a rotative gearing operating a fan, rotate a bottle cleaning brush, or other similar work, a spring lever being pivoted to the handle of the frame, and the apparatus being driven by pressure of the thumb applied intermittently to the lever.

TOBACCO PIPE. — Henry Hunt and Henry Hunt, Jr., Wilkesbarre, Pa. This pipe has an elongated tubular mouthpiece extending nearly to the bowl and inclosing the stem proper, in the top of which is a groove forming a smoke passage, while a groove on the under side forms a receptacle for moisture. A ferrule frictionally connects the stem and mouthpiece, without screw connections, and the mouthpiece is readily removed to facilitate thorough cleaning.

INSECT TRAP.—Thomas R. L. Daughtrey and Andrew M. Cowart, Punta Gorda, Fla. For roaches, flies and similar pests, these inventors have devised a trap of semicircular shape, with flat sides and rounded portion covered by wire netting, having cone-shaped entrances by which insects may enter but preventing their escape. The trap has a sliding bottom, and when filled may be placed over a fire and the bottom removed to destroy the vermin.

Designs.

EXERCISING CLUB.—Alfred M. Heydrick, South Norwalk, Conn. This club is in the form of a bar having enlarged tapering end portions, of a contour similar to that of an Indian club.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

BULLETIN 44. West Virginia Agricultural Experiment Station, Morgantown, West Virginia. PRACTICAL ENTOMOLOGY. Insects injurious to farm and garden crops. The character of the injury. The insect causing it. The remedy briefly and plainly stated. A. D. Hopkins and W. E. Rumsey. Charleston: Moses W. Donnally, Public Printer. April, 1896. Pp. 325.

We note the reception from West Virginia Agricultural Experiment Station of this pamphlet. It gives an indication of the study of the new entomology and the conversion of the old entomology into an every day useful science.

INFALLIBLE LOGIC. A visible and automatic system of reasoning. By Thomas D. Hawley. Lansing, Mich.: Robert Smith Printing Company. 1896. Pp. xxviii, 659. Price $5.

In this work, we find logic treated from the student of geometry standpoint. The author has worked so hard and has given such elaborate treatment to the subject that we feel in a certain sense guilty in not being able to give the book an adequate review. The examples are not only very interesting, but they show that the species of geometrical construction termed by the author his reasoning frame has really very practical application to the methods of reasoning and of reaching conclusions. We are convinced that the work will repay study, and the examples and fallacies make a thoroughly interesting section. The historical notes are of decided value. The notes of the different logicians, with extracts from typical works, are excellent. An index is included. The conservatism of the author is shown by the fact that he accepts the view of authorities that Aristotle was the first scientific logician.

L'AMELIORATION DES PORTES DE FER ET DES AUTRES CATARACTES DU BAS-DANUBE. Par Bela de Gonda. Avec un plan et 100 illustrations. Budapest: Imprimerie Orszaggyulesi Ertesito. 1896. Pp. iv, 265.

We have given considerable space in our columns to the improvement of the iron gates of the Danube. It is with great pleasure that we note the reception from M. Bela de Gonda of his work on the subject, profusely illustrated and with full engineering details. It will be found a most useful work for civil engineers and its views of natural scenery will make it of interest to the public at large.

THE INTERNATIONAL ANNUAL OF ANTHONY'S PHOTOGRAPHIC BULLETIN. Edited by Frederick J. Harrison. New York: E. & H. T. Anthony & Company. 1897. Pp. 304. Price $1.

This annual appears in its usual excellent letterpress and contains numerous articles and suggestions on the details of various branches of photographic work, full of value and usefulness to the photographer. The latter half of the book refers more particularly to a description of processes and formulas bearing on photoengraving, process work, etc., with a directory of photographic societies. In addition to this there are many illustrations, some of which are interesting and instructive.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7072) R. B. D. writes: 1. Is old lead pipe sufficiently pure for storage battery plates? My battery will not remain charged, and I presume that it is because of local action on the surface of the plates. A. The old lead pipe should work for your battery. Probably there is a short circuit somewhere, either within the cell or between the plate terminals outside. Dampness might be at the root of the trouble. 2. In order to seal my storage cell with a permanent cover I filled the spaces between and around the plates with salt, filling the cell to within three-eighths inch of the top, and then poured a melted compound of paraffine wax and resin over the salt until the jar was full. When the compound was cool I inserted two tubes into the cell and got rid of the salt by passing a stream of water through the cell. Is it probable that the brine would injure the plates in this operation? A. This process should do no harm, provided the salt was all washed out. Otherwise the chlorine of the salt might affect the operations of forming, charging and discharging, or the hydrochloric acid set free might attack the lead and cause undue formation of lead sulphate.

(7073) S. A. says: Please give me a good formula for making white frosting, such as painters use on windows, that will stand a considerable heat. A. Put a piece of putty in muslin, twist the fabric tight and tie it into the shape of a pad; well clean the glass first, and then pat it over. The putty will exude sufficiently through the muslin to render the stain opaque. Let it dry hard and then varnish. If a pattern is required, cut it out in paper as a stencil; place it so as not to slip and proceed as above, removing the stencil when finished. If there should be any objection to the existence of the clear spaces, cover with slightly opaque varnish.

(7074) R. N. writes: 1 I am going to build a two sixteen candle power light dynamo. The dynamo I am using as a model is made to give an E. M. F. of 25 volts and a current of 8 amperes by using 8 pounds of wire No. 14 for the field cores and 1½ pounds No. 18 for the armature. By winding proper sizes of wire on the armature and field cores, any strength of current or potential should be obtainable within limits. 1. Now, I would like to know how many pounds and what size of wire should be used for the field cores and armature to obtain an E. M. F. of 100 volts and a current of 2 amperes. A. A rough, approximate rule to change voltage is to use wire whose cross sectional area is in inverse proportion to the voltage desired. Thus, if No. 14 and No. 18 wire respectively give 25 volts, then apply the proportion cross sectional areas of No. 14 and No. 18 respectively. Cross sectional area of desired wires : : 100: 25. This gives us No. 20 and 24 wire. 2. Could the wire on the armature and field cores be wound in four equal sections and connect these sections either in series or parallel like the armature of the magneto-electric machine in "Experimental Science," page 484, to secure a current of different voltage, say 100, 50, and 25 volts? A. This could be done, but would introduce more complication. 3. Would you advise to soak the wire in a solution of shellac while winding? Would single covered wire be safe? A. Use double covered wire and apply shellac to each layer after winding it on. 4. Please state the relative conductivity of aluminum. A. Copper=1. Aluminum=0·56 approximately.

(7075) C. O. H. writes: 1. I have a telephone line of about a quarter of a mile in length, using the Bell receivers. Every night, as soon as the arc lights in the streets are turned on, there is a peculiar humming noise heard in the telephone. Part of the way the line runs parallel with the arc and incandescent light wires, but not less than 50 or 100 feet from them. What is the cause of the humming, and how can it be remedied? A. The electric light circuit causes the trouble. A metallic circuit will greatly or entirely reduce it. 2. Would there be too much resistance to use transmitters made exactly like the receivers? A. No. 3. Would not the motor in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, be much strengthened by filling in between each section of coils on the armature with pieces of sheet iron fitting closely to the core? A. At the expense of considerable additional complication this could be done. It would slightly increase the efficiency.

(7076) R. G. B. says: Can you suggest something that will prevent rust forming on steel surgical instruments? They are used only occasionally (3 or 4 times a week) and are in a dry cabinet in a dry office. It won't do to nickel plate them. A. 1. Clean frequently; after using, clean with dry chamois leather and wipe off with an oiled rag. 2. For this purpose the Lancet confidently recommends a mixture of equal parts of carbolic acid and olive oil, smeared over the surface of the instruments. This plan is much used by medical officers in the navy, and is found to preserve the polish and brightness of the steel, however moist and warm the climate may be.

(7077) D. E. S. asks: 1. Please answer the following questions as soon as convenient: 1. In transmitting music, speech, etc., by telephone would two dust transmitters with 500 ohm induction coils give better results, than one? Could two or more induction coils (500 ohms) be connected up with one transmitter to give loud results, and how connected? A. A single dust transmitter with proper collecting trumpet or cone should answer. We do not advise the use of more than one transmitter. 2. Can a funnel be attached to an ordinary telephone receiver so that all in a room may hear? Is there any loud receiver made? If so, by whom? If not, how could one be made? A. Yes; a large funnel helps, but the sound is apt to be rather weak. The loud speaking telephone of Edison is described in SUPPLEMENT, Nos. 127 and 138; other illustrated articles on such telephones will be found in SUPPLEMENT, Nos. 165, 207, 339, 350, 506, 719, 711, 769, and 997; price 10 cents each. 3. What is considered the best form of transmitter for long distance work—carbon contact or dust? A. The dust telephone. 4. For experimental work, what is the best and cheapest thing that can be introduced into a circuit to add resistance? A. A carbon rod laid in a groove in a paraffined board with sliding contact is excellent. Or simply use iron wire coils, remembering that unless wound antiinductively, i. e., doubled at center, they will create magnetic fields and affect delicate instruments. By using several carbon rods of different diameters a large range may be secured. See articles on the engineering details of long distance telephones, also the cost of such telephones, in SCIENTIFIC AMERICAN, No. 4, vol. 64, No. 2, vol. 66, and No. 2, vol. 72, also SUPPLEMENT, Nos. 882, 836, and 895; price 10 cents each by mail.

(7078) J. J. H. asks for a good recipe for polish for brown russet leather shoes.

A. 1. Soft soap..... 2 parts.
Linseed oil..... 3 "
Annatto solution (in oil)..... 8 "
Beeswax..... 3 "
Turpentine..... 8 "
Water..... 8 "

Dissolve the soap in the water and add the annatto; melt the wax in the oil and turpentine, and gradually stir in the soap solution, stirring until cold.

2. Palm oil..... ....16 parts.
Common soap..... ....48 "
Oleic acid..... ....32 "
Glycerin..... ....10 "
Tannic acid..... ....1 "

Melt the soap and palm oil together at a gentle heat, and add the oleic acid; dissolve the tannic acid in the glycerin, add to the hot soap and oil mixture, and stir until cold.

3. Oil of turpentine.....20 parts.
Yellow wax..... 9 "
Common soap..... 1 "
Boiling water.....20 "

Dissolve the wax in the oil with the acid of the water bath, and the soap in the water; mix the two solutions in a hot mortar, and stir until cold.—American Druggist.

(7079) C. H. B. writes: Is it a poor plan to connect batteries of different kinds, or of different degrees of exhaustion, together in series, and, if so, what constitutes the objection? A. The principal rules for batteries are these: To obtain the maximum current from a given number of cells the internal resistance must be equal to the external. To obtain high efficiency make the internal resistance as low as possible and concentrate the resistance on the work. It is quite immaterial whether batteries of different kinds be mixed as far as the mere question of mixture is concerned. The efficiency will depend on the efficiency of the component cells and no more. Exhausted cells will by their inferiority reduce the quality of the combination.

(7080) R. C. P. asks how a motor may be transformed into a dynamo. A. No change is necessary, except that motors are less critical in requirement, practically speaking, than dynamos, and as built are apt to make poor dynamos. A thicker core, smaller air gape, cast iron for field core and laminated armature core should be employed in dynamos.

(7081) R. B. W. asks: How many hours in your judgment would six Mesco dry batteries, largest size, continue to furnish a spark of sufficient size to ignite gas successfully in a two horse vapor stationary engine? And would you recommend the use of dry instead of a wet battery? A. We cannot give any satisfactory answer, but would incline to recommend Leclanche batteries in place of dry batteries.

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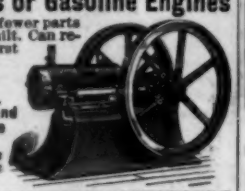

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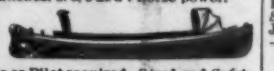

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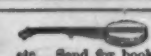

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